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THE

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1901 Edition

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MUNICIPALITIES AND PROFIT-EARNING.

THE position of local authorities owning electricity works with respect to profit-earning is a difficult one. On the one hand, no little pressure is brought to bear upon the engineer and those to whom he is directly responsible to produce a yearly surplus in the balance sheet, a portion of which can be applied to the relief of the rates, and consequently credit is taken by the corporation for the assistance which such a department renders towards meeting the liabilities of the council. On the other hand, requests are received from residents in different parts of the local authority's area for a supply of electrical energy, and the representatives of the different wards or districts usually press the claims of their constituents to be noticed. A company operating with a view to dividend-earning can apply a very simple rule, that of return upon the capital expended or necessary, to such cases, but local bodies are prone to much short-mindedness, and strive to meet the wishes of those who to-day are most vigorous in making themselves heard. As a result, it very often happens that prices or rates of charge for electrical energy are reduced, that expensive and important extensions of mains are undertaken, and that elaborate schemes of street lighting are passed without much attention being paid to the financial result which must necessarily follow when these changes have been in operation for a sufficient length of time to make their influence felt in the balance-sheet.

We recently referred to the explanation which the Islington Electric Lighting Committee had to place before the Borough Council on the position and prospects of the electricity department. The Manchester Corporation is commonly regarded as the possessor of a phenomenally successful electrical supply department, and as some rather interesting and plain-spoken facts have been placed before the City Council at a recent meeting, we think some attention may well be given to them as representing another phase of the question. The results of the last four years were reviewed, and to make matters plain we give some of the figures :—

Year.	Capital.	Length of mains.	Maximum load.	Number of consumers.	Units sold and accounted for.	Net profit.
1896	£309,191	33 m. 1,353 yds.	2,737 KW.	1,581	2,775,107	£16,812
1897	£357,617	45 m. 902 yds.	3,776 KW.	1,981	3,641,599	£13,523
1898	£493,716	74 m. 217 yds.	4,246 KW.	2,570	5,214,221	£17,188
1899	£641,821	110 m. 45 yds.	5,607 KW.	3,240	6,468,405	£9,764

The Committee confessed that their estimates for the forthcoming year are the most unsatisfactory yet submitted ; in other words, the relation between capital and revenue is unfavourable, and a loss is inevitable. The capital expenditure has been rising steadily, the reserve fund, which should stand at something like £80,000, only reaches £13,000, the estimated capital expenditure for the next 12 months amounts to no less than £400,000, or, say, 46 to 47 per cent., while the anticipated increase in revenue is but £17,400, or about 19 per cent., of which £11,187 is expected to be derived from the energy sold for traction purposes, and as this is delivered on terms which yield an infinitesimal profit, the real increase in revenue is only the difference of these two sums. It is urged, with reason, that

while certain moneys must be allocated to mains extensions, it is equally essential that corresponding sums should be set apart for additional generating plant. It is admitted that mains have been laid out of all proportion to the extensions of generating plant. Thus in the past 12 months £150,000 have been spent upon new mains, but owing to delays, out of £93,000 provided for construction of the Bloom Street station only £29,000 was disbursed. The policy of rushing ahead with mains four or five miles from the generating station, when it was impossible to keep up such a pressure as would satisfy customers in the districts concerned, and when there were thousands of applicants close at hand who were waiting to be connected, was characterised as outrageous. The mains extensions appear to have run ahead of the ability to make use of them, with the consequence that charges for interest and sinking fund have to be met from some other source than by revenue derived from customers connected to them. Owing to the delays in getting new machinery to work, the existing plant has been overloaded, and all the available power has been at work, with nothing in the way of reserve to fall back upon in the event of a breakdown. Obviously the profits must be affected by such a state of things.

The outlook does not, however, satisfy some of the Councillors, who, being anxious to keep up payments to the rates, want the estimates altered to enable profits to be made by increased charges. This abortive attempt to stretch one's cloth to cut in the desired fashion instead of cutting one's coat according to the cloth available, led to the refutation of the principle that whenever a municipal trading body is unable from any cause to make a profit which is expected of it, it should be compelled to provide that profit by raising the price of the commodity which it sells. The Committee never anticipated that when it was making a loss it would be asked to provide a sum in relief of the rates, and frankly said it could not do it.

As the local press has stated, it would be a most unwise policy for such an undertaking to adopt, to have to raise the charges to consumers. For the electricity supply department to think only of making an immediate profit may gravely compromise its future. The supply dates from 1893, in which year there was a deficit of £210, turned into a profit of £5,709 in the following year. The results afterwards were as follows:—

Year.	Paid over to the credit of the rates.	Paid into reserve fund.
1895	£6,964	£8,521
1896	10,000	7,965
1897	10,000	3,523
1898	12,000	3,188
1899	10,000	1,765

The moral of all this is that mains should be laid only in response to a reasonable demand in districts likely to prove remunerative; that the rates charged should not be rushed down unless an ample reserve (and if possible a reasonable depreciation fund) has been created; that delays in starting up new plant must be provided against; and that contributions towards the rates, mere flea bites as a rule, might often be more usefully employed in building up a sound and stable business position. The experience of Manchester is likely to be repeated in other quarters, and as local authorities have few opportunities of maintaining that secrecy so essential to most business undertakings, it would seem that if our municipal departments are to maintain their position, engineers and managers must not be worried about the dismissal of an incompetent artisan, or the means by which an office boy has been engaged, but must be given every facility for studying and consolidating the commercial interests of the undertakings and departments of which they are at least the technical and executive heads.

Maintenance of Tramway Track.

In several cases of recent date, questions have arisen as to the liability of tramway companies to keep their lines and the track between the lines in good repair and order. As a general rule, the duty of attending to such matters is imposed upon the tramway company by their provisional order or special Act, the liability being taken over from the highway authority. Questions which were of no moment in connection with horse tramways have assumed considerable importance now that the lines are used for electric trams. Thus the sanding of the track between the rails does not serve any useful purpose for a tram propelled by mechanical means; while the watering of the lines, although formerly important in ensuring easy running, is now necessary in order to keep the rails clean and secure a good electrical contact. In the case of the Mayor of Middlesbrough *v.* The Imperial Tramways Company, the plaintiffs sought an injunction to restrain the defendants from pouring water on the lines of their tramway within the borough of Middlesbrough, so as to cause the road to be in a wet and sloppy condition. It was shown that by the Tramways Orders Confirmation (No. 3) Act, 1897, Sec. 6, the defendants were authorised to construct or maintain a tramway which might be worked by animal power or by electrical power on the overhead system. According to plaintiffs, the defendants had watered the lines to such an extent with the ordinary moving tank, that the highways had become rotten and unsound. The defendants' case was that there was no nuisance at all; and that if the water lay too long, it was because of the defective construction of the roads. Any water that did overflow would remain on the track, *i.e.*, on that portion of the road which the defendants were bound to repair. They called witnesses from a number of large towns where electric trams are used, who proved that it was necessary to use water to get rid of the dirt in the rails, because it spoiled the contact and caused sparking and slipping. Other witnesses proved that the water had not been the cause of any accidents. Mr. Justice Wright gave judgment for the plaintiffs, in the course of which he said:—"I am satisfied that the water system of cleaning tramways is a proper one. . . . If there was a serious nuisance, it was only when the company was experimenting a few days after the trams were opened; since then any nuisance there has been, has been caused by the fact that the roads were flat and were not provided with proper gutters."

Another case of interest is Barnett and Another *v.* Poplar Borough (17 T.L.R. 461). In that case the plaintiffs brought an action to recover damages in respect of an injury caused to a van belonging to them, by coming in contact with one rail of a tramway belonging to the North Metropolitan Tramways Company. The rail stood up above the street owing to the alleged neglect of those who were responsible for the repair of the track. Under Sec. 28 of the Tramways Act, 1870, it is the duty of the tramway company to repair that portion of the road which is between the rails—but by Sec. 29 the road authority and the tramway company have power to contract with each other in respect of such repairs. It was proved in this case that the defendants were under contract to do their repairs, and it was urged on behalf of the plaintiffs that this rendered them liable for the consequences of non-repair. This view was upheld by the Lord Chief Justice and Mr. Justice Lawrance. They relied on the case of Alldred *v.* West Metropolitan Tramway Company (1891), 2 Q.B. 398, in which it was decided that where a tramway company has entered into a contract with the road authority under the Tramways Act, whereby such authority has undertaken the repair of the portion of the road which, under Sec. 128, the tramway company has to repair, the tramway company is not liable for injuries occasioned through non-repair of such portion of the road to a person using the same. The question whether an electric tramway company is bound to lay sand upon the track between the rails in fulfilment of their obligation to keep in good order and repair, has not yet been decided in this country. In Dublin, however, a prosecution of the Dublin United Tramways Company for not laying sand was successfully carried through, and the conviction was affirmed in the High Court. As it was a criminal cause or matter, the company were unable to proceed to a higher Court. We observe, however, that in an action which has recently been brought against the company for personal injuries sustained by the plaintiff in an accident on the tramway, the defendants are raising the plea that they are under no liability to lay sand. This case may, in the course of time, reach the House of Lords, who will be in a position to finally decide this important question.

EXPERIMENTS IN WIRELESS TELEGRAPHY WITH THE GUARINI AUTOMATIC REPEATER.

BRUSSELS—MECHLIN—ANTWERP.

Up to the present, wireless telegraphy has been looked upon by electricians as an ingenious and remarkable discovery not possessing any great practical utility. They have always had two serious objections to urge against this system of transmission, viz., the possibility of intercepting communications and the impossibility of transmitting messages to great distances. Quite recently Prof. Fleming stated in the *Times* that the last experiments made by Marconi between Poole, in Dorsetshire, and St. Catherine's Point, in the Isle of Wight, prove that henceforward messages may be rendered incapable of interception, and that duplex wireless telegraphy is capable of realisation, at any rate in one direction.

Again, Prof. Fleming, at his conference on February 12th, 1901, at the Chamber of Commerce, Liverpool, announced the last results obtained by Marconi at a distance of 315 km. between the Lizard and St. Catherine's Point. But these results related to communications over the open sea, the system, as we know, having failed on land.

With regard to land communications, we give below the report laid before the Paris Congress, September, 1900, by Messrs. Blondel and Ferrié :—

"The inland experiments have been less brilliant. In the majority of cases captive balloons or kites have had to be employed in order to obtain sufficiently high antennæ.

In 1897 Mr. Slaby succeeded in receiving signals at 21 km. with antennæ of 500 metres supported by captive balloons.

In 1898 M. Voisenat obtained good results at 10 km. with antennæ of 40 metres.

In 1899 Marconi, with the assistance of Capt. Bret and Capt. Kennedy, was able to communicate between Salisbury and Bath, a distance of 54 km., by means of very high antennæ supported by kites. It does not, however, appear that in the Transvaal, notwithstanding the announcement of the first results, much use has been made of the apparatus for wireless telegraphy which was sent over for military purposes.

Lastly, experiments were performed under special conditions by M. H. Lecarme in a mountainous district between Mont Blanc and Chamounix (1899). The communication was very regular, notwithstanding the rocky nature of the ground and the want of conductivity in the ice which covers it. With a free balloon the results were equally interesting. Signals could be received in the balloon when the receiving antenna (50 m.) was parallel to the transmitting antenna (40 m.), and at a great height. Communication was thus able to be established at a distance of 8 km. and a height of 800 m."

To these results must be added those obtained by the Allgemeine Electricitäts Gesellschaft with the Slaby-Arco system. This company succeeded in establishing communication by wireless telegraphy between their central station at Berlin and their cable works at Ober-Schönweide —a distance of about 15 km.

From what we have just said, it appears that up to the present it has not been possible, without the aid of captive balloons or kites, to communicate overland through obstacles to a distance of 41 km. (the distance which separates Brussels from Antwerp); in fact, not beyond 21 km. (the distance separating Mechlin from Brussels and Antwerp).

M. Guarini's experiments, the results of which we shall now sum up, are the more interesting from the fact that they are the first made overland between two populous towns like Brussels and Antwerp, the antennæ being placed in the very heart of these towns, and, what is more, supported—the installations were merely provisional and consequently hastily prepared—by public monuments.

No doubt in subsequent trials with installations arranged under better conditions M. Guarini will considerably extend the range of transmission for his overland apparatus.

We must not, however, deceive ourselves on this point, for it is very certain that the range will not be extended indefinitely, but that nature will, at a certain limit, place in our path an impassable barrier. However great may be the energy at our command at a transmitting station, losses are inevitably incurred along the course of the Hertzian waves, which thus arrive at the receiver considerably weakened. These losses are mainly due to the production of heat during the passage of the waves through more or less resisting bodies, to their successive reflections and deviations over metallic substances, &c.

Radiation itself is a very important cause of weakening of energy. The height of the antenna increases with the distance to be traversed; therefore practicability of installation and the question of expense will be opposed to any considerable increase of distance. The receiver itself, which is a tube of iron filings, or an imperfect contact, is a detector

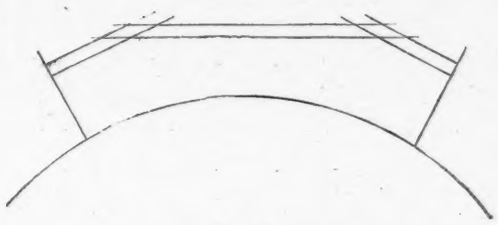


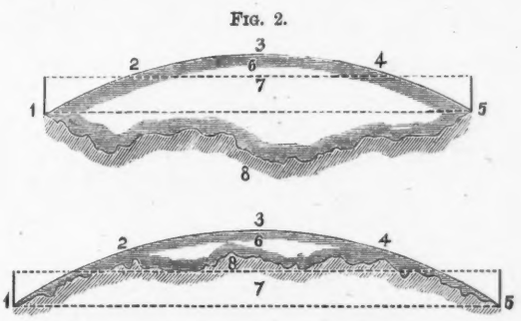
FIG. 1.

that can with difficulty be rendered perfectly sensitive to Hertzian waves. The progress that can be made in this last respect will always be insufficient, since, owing to the losses already mentioned, the Hertzian waves will become hopelessly indistinct at a certain distance from the station where they are produced.

It would be a Utopian idea to try to concentrate the Hertzian waves within a certain determined area of space, in order to enable them to extend to any distance. The earth is round, and the waves are propagated in a straight line, as shown by Hertz's experiment on the stoppage of electric waves by a metal screen. The sheaf of concentrated waves must be bent to follow the curve of the earth by successive deviations or reflections (fig. 1), and thus the series of losses begins.

If we wish to dispense with the employment of deviators or reflectors, we can never raise the radiator sufficiently high

FIG. 2.



1, 5. Antennæ. 2, 3, 4. Curvature of sea. 6. Sea water. 7. Sheaf of rays. 8. Sea bed.

FIG. 3.

at the transmitting station, or the collector at the receiving station, to allow of communication between two stations, at the antipodes, for instance.

There is therefore a limit to the distance to which messages can be sent without wires overland, mainly on account of the curvature of the earth.

Thus the electric waves, although they may pursue their course over certain obstacles on the surface of the earth, are sooner or later stopped suddenly by the curvature of the earth itself. At sea the curvature of the earth has less effect, as the electric waves pass through the water (fig. 2), and in this case the absorption depends on the quantity of salt in the water. The curvature of the earth only intercepts wireless telegraphy at long distances at sea when the electric waves come in contact with the bottom of the sea (fig. 3). On land the absorption resulting from intervening buildings and eminences is considerable, and a receiver placed under-

ground (fig. 4) is not affected at all, as has been proved by a recent experiment made by M. Eugène Lagrange, Professor of Physics at the Ecole Militaire, Belgium (*Comptes Rendus de l'Académie des Sciences de Paris*, January 28th, 1901).

Consequently we must have recourse to other means to solve the problem of wireless telegraphy to any distance.

Ordinary electric telegraphy, nay, even the earliest electric telegraphy, gives a solution in the principle of relays or translators.

The translator or repeater should be capable of receiving the electric radiations proceeding from a terminus or a relay, of imparting renewed energy to these radiations, and of sending them on to the other terminus or to another

1. Transmitter. 2. Receiver. 3. Wooden Box. 4. Earth.

FIG. 4.

relay station. For the solution to be practical we must not content ourselves with placing at this relay a receiver which will receive the message and a transmitter which will then send it on in the required direction. In fact, under these conditions, if at the departure station, for instance, the message required one hour's manipulation, it would be delayed two hours at each successive relay—one hour for the reception and one for the re-transmission. So that if at the intermediate station there were five of these relays (which is quite a reasonable supposition, for duplex wireless telegraphy having already been realised in one direction by Marconi, we may be allowed to prophesy the realisation of quadruplex telegraphy, and so on, on the same principle), five operators would be required for the repetition service.

Assuming that we can attain to 500 km. in direct transmission, to send a message round the world we should require 80 intermediate relays, the circumference of the earth being about 40,000 km. Assuming the same duration for the manipulation and reception, $1 + 80 \times 2 + 1 = 162$ hours would be required for the transmission, or nearly seven days. It is indispensable that we should have in the intermediate relay station a single apparatus to repeat the message at the same time that it receives it; this repetition should be effected automatically in order to save labour and time. Thus every automatic repeater consists essentially of a receiver and a transmitter, the transmitter being worked automatically by the receiver; our message will not then take much more than two hours to go round the world, the only delay being the time required to overcome the inertia of the various instruments.

(*To be continued.*)

CHOICE OF TYPE AND PERIODICITY FOR ELECTRIC TRACTION PLANT.

By H. M. HOBART.

DURING the last year or two a good deal has been written on subjects relating to the relative merits of rotary converters and motor-generators, low-speed and high-speed engines, and on parallel running. The three questions have a more decided bearing upon one another than appears to be realised. In fact, while the present article deals with no strictly new idea, it has been written as the result of a conviction that the logical consequences of the experience of the last few years in these matters have not yet been clearly appreciated. Though many writers bring out interesting and useful conclusions, all seem to have missed the main point.

Polyphase transmission systems with rotary converter sub-stations have now been installed in large numbers and operated with very gratifying results. Whatever considerable difficulties have been met with in their operation, have been attributable to lack of sufficiently uniform angular velocity in the prime movers. The writer quite disagrees with a current opinion that "hunting" difficulties in rotary converters are ever due to causes other than those originating in this lack of perfectly uniform angular velocity in the prime movers; at any rate, any other causes are of the most subordinate importance. Given a uniform angular rotation of the generators, the way is perfectly clear for entirely satisfactory operation of the rotary converters without any damping or other equivalent auxiliary devices. A consideration of the matter of obtaining sufficiently close phase regulation in the generators, leads to the following observations:—

Two entirely different classes of generating plant are at present being advocated by engineers, and there is not the slightest likelihood that within less than several years electrical manufacturers will be relieved from the necessity of supplying apparatus of two altogether different types. These two types are respectively those for high speed and those for low speed engines. Take as a representative instance the case of a central station to be equipped with several 1,000-H.P. units. In the one case these will be arranged to run at, say, 250 revolutions per minute, in the other at about 83 revolutions per minute. In the former case the problem of operating rotary converters satisfactorily is greatly simplified. The customary lowest limit for the periodicity is 25 cycles per second. This—for the speed assumed—requires but 12 poles. A further customary requirement is that the phase deviation from perfect uniformity shall never exceed 2·5°, or 0·7 per cent. Hence the displacement in space from the positions corresponding to absolutely uniform angular rotation must not exceed $\frac{0{\cdot}7 \text{ per cent.}}{6} = {\cdot}12$ per cent. of the entire circumference. With an engine exerting a fairly uniform turning moment, and at the relatively high speed of 250 revolutions per minute, this should not require an excessively large fly-wheel. The case would be very different for the low-speed generator. At 83 revolutions per minute 36 poles would correspond to 25 cycles per second, and the angular deviation from uniformity would have to be less than ·04 per cent., which for the low speed of 83 revolutions per minute would, for the best of such engines, require a tremendous fly-wheel. In practice a less close degree of regulation would probably be decided upon, and the rotary converters would be made to run satisfactorily by wrought-iron pole-faces, damping plates, or pole-face damping windings, or the generators might be equipped with similar devices. But these will not result in so satisfactory working as would be the case with a plant in which no such troublesome tendencies exist. Moreover, at least 1 per cent. or 2 per cent. of energy would doubtless be dissipated in such devices. For the low speed plant the writer would be inclined to lower the periodicity to, say, one-third of the present customary minimum value—*i.e.*, to $8\frac{1}{3}$ cycles per second, and to employ generators with but 12 poles. At this low periodicity, step-down transformers would be very expensive, and the writer would abandon rotary converters and equip the sub-stations with 6-pole high potential synchronous motors running at 165 revolutions per minute, direct connected to first-class 600-volt railway generators. The lower efficiency of such a set—as compared with step-down transformers and rotary converters—would be so nearly offset by the decreased energy requiring to be expended in devices for overcoming hunting, as to bring the commercial efficiencies of the two plants within 2 per cent. or 3 per cent. of one another. It must also be remembered that there are two distinct difficulties thus overcome, or at least greatly modified—first, the paralleling of the generators with one another; and, secondly, when that is successfully accomplished, it still remains an open question whether the combined parallel running is sufficiently free from angular deviations to deliver satisfactorily constant periodicity to the rotary converters. The writer agrees with the views of some other engineers that it is open to question whether the most liberal of fly-wheels will necessarily lead to satisfactory parallel running of the generators. Quite contrary, however, to the general opinion, the writer believes that the larger the momentum of the rotor of the rotary converter, the more independent will it be of these disturbing

tendencies. This latter opinion, however, does not affect the conclusions reached in the present article.

Of the higher cost of sub-station motor-generators as compared with step-down transformers and rotary converters, I may say that the great simplification in switchboard apparatus, the less need for close regulation in the high tension mains, the dispensing with all auxiliary devices required for voltage adjustment and the far less skilled attendance required, will largely or altogether offset the difference in cost. Moreover, the railway generator employed in the sub-station would be of the normal construction best suited for the requirements, and such a machine of the highest grade may, owing to standardisation and keener competition, be obtained from the manufacturers at a cost much less in excess of that of a rotary converter than that represented by the intrinsic values of material and labour in the two machines.

In concluding, the writer would sum up his opinion as follows:—For future traction projects, the rotary converter should be superseded by the motor-generator, and the periodicity should be still further lowered for the case of very slow speed steam engines; but it may often still be advantageous to employ rotary converters, and at 25 cycles per second, for plants where the generators are direct connected to high speed engines.

CURRENT SPECIFICATIONS.

LXIII.—KINGSTOWN LIGHTING PLANT.

SUMMARY.

Extent of Contract.—Contract No. 2.—Equipment of an electricity supply station. Contract No. 6.—Supply and erection of 60 arc lamps and pillars for public lighting.

System Employed.—Direct current three-wire low tension system, with balancers and accumulators, the voltage across outers at station being 500 volts.

Type and Number of Boilers.—Three to be supplied, of Lancashire type, each 30 ft. long by 7 ft. 6 in. diameter, to conform with latest standard practice.

Working Pressure.—160 lbs. to square inch.

Type of Fuel Economiser.—To be either of Messrs. Green's or Lowcock's manufacture, having two sections, each containing 96 tubes.

Method of Driving Scraper.—By means of electric motor, for which, with accessories, the sum of £40 is to be provided in tender.

Type of Boiler Feed Pumps.—To be of differential single-acting type, Messrs. Weir's or other approved make.

Number and Size of Feed Pumps.—Two to be provided, each to be capable of pumping 1,800 gallons of water against a boiler pressure of 160 lbs. per square inch.

Type and Size of Feed Water Heater.—To be of Berryman or other approved type, capable of heating 1,800 gallons of water per hour to a temperature of not less than 200° F.

Number and Size of Steam Dynamos.—Two of 150 KW. output and one of 75 KW. output.

Type of Engines.—To be either compound or triple expansion at option of tenderer, with preferably three cranks at 120° distance apart.

Speed.—Left optional with tenderer.

Range of Governing.—Not to allow the speed to vary more than 3 per cent. on either side of normal between full load and no load.

Voltage of Generators.—Dynamos to be shunt wound, capable of working with constant speed at any voltage between 480 and 530 volts. Machines may be either two-pole or multipolar at option of tenderer.

Permissible Temperature Rise.—Not to exceed 70° F. above atmosphere after six hours' run at normal full load.

Specified Steam Consumption.—When working exhausting to atmosphere with 155 lbs. pressure, the steam consumption per kilowatt-hour at full load must not exceed for the 150-KW. set 33 lbs., or for the 75-KW. set 34·5 lbs.

Bonus and Penalty for Steam Consumption.—£50 per 1 lb. of steam for 150-KW. set, and £25 per lb. of steam for the 75-KW. set, and *pro rata* for fractions of a pound. Two and one-half per cent. margin to be allowed before bonus or penalty commences.

Capacity of Motor Balancer and Booster.—To consist of four machines, two to act as balancers, each capable of developing 105 amperes at 265 volts, the other two as boosters, each to give up to 150 amperes at 100 volts, the speed of the combination not to exceed 900 revolutions per minute.

Type of Switchboard.—To be fitted with instruments as specified, and to be suitable for two 150-KW. and one 75-KW. dynamos, motor balancer and booster, cells, and eight feeders, all arranged to supply a three-wire direct current system.

Capacity of Battery.—To have a capacity of not less than 600 ampere-hours when discharged at an eight-hour rate, with a terminal voltage of not less than 510 volts. The battery to have a capacity of 540 ampere-hours when discharged in three hours.

Conditions of Maintenance.—Six months' maintenance from date of completion to be included in tender, and purchaser to further have option of asking contractor to maintain the battery to *full rated capacity* for a term of years at the sum per annum stated in tender.

Type of Arc Lamps.—To be double carbon direct current 12½ ampere lamps, of Brockie-Pell, Crompton-Pochin, or other well known and approved type.

Number Required.—60.

Type and Number of Standards.—60 required, of Messrs. McFarlane's manufacture or other maker of equal repute, each 27 ft. 6 in. high.

Type of Incandescent Lamp Fittings.—Two glow lamp fittings and suitable brackets to be fitted to each arc lamp pillar.

Specified Date of Completion.—Boiler section, four months; remaining section, six months from receipt of order.

Penalty for Late Completion.—One-half of 1 per cent. per week of contract price for each section.

Specified Terms of Payment.—80 per cent. of value of work delivered on site, 10 per cent. one month after works have been taken over by contractor, 10 per cent. six months later.

Period of Maintenance.—Six months from date of completion against all defects due to faulty workmanship or material.

Stipulations as to Removal of Foreman.—Satisfactory.

Stipulations as to Wages to be paid to Workmen.—Acceptable. See comments below.

Amount of Sureties.—Two to be provided to be bound jointly and severally in a sum equal to 15 per cent. of accepted tender.

Arbitration Proposals.—None.

Date for Receipt of Tenders.—May 29th, 1901.

Messrs. Kincaid, Waller & Manville, the consulting electrical engineers to the Corporation of Kingstown, are responsible for the preparation of this specification.

Looked at from a technical standpoint, it is one of the best we have examined for a long time. For instance, the boilers are specified to be of a definite size and of Lancashire type, and particulars are given as to the tests the materials are to undergo, and the mountings which are to be supplied, but there are no vexatious stipulations as to the evaporative duty of these particular boilers. The engineers know that given a boiler of the size, type and quality specified, it will fulfil their requirements, and are satisfied. The means to be adopted are stated, given these they will accept responsibility for the results.

In the same way the engines and dynamos may be of any well-known types. It is open to tenderers to offer compound or triple expansion, and a preference is expressed for three-crank engines, but with this exception the engineers are content to specify the results to be obtained, leaving the means by which this is done optional with tenderers. No limits of speed are stated with the steam dynamos, but the steam consumptions which will be guaranteed at full, three quarter and half load, are to be clearly stated. At full load working non-condensing with 155 lbs. steam pressure at stop valve, the steam consumption per KW.-hour shall not exceed 33 lbs. for the 150 KW. set, and 34½ lbs. for the 75 KW. set under a bonus and penalty of *£50* and *£25* per complete pound of steam variation, and *pro rata* for fractions of a pound, a margin of 2½ per cent. being allowed before the stipulations become operative.

The motor balancer and booster consists of four machines having their armatures rigidly connected together, the two balancing machines each having an output of 25 KW., and the two boosters each a maximum output of 15 KW.

The battery, it will be noted, has to have a terminal voltage of 510 volts at the end of an eight hours' discharge, a capacity under these conditions of 600 ampere-hours, and after six months' free maintenance a price is to be quoted for annual maintenance up to full rated capacity.

The arc lamps are to be of the double carbon 32-hour burning type, of a well-known make, to be approved by the engineers.

Dealing with the general conditions, in many respects they follow the suggestions made by the Joint Committee of the Municipal Electrical Association and the Electrical Plant Manufacturers' Association.

The penalty for late completion is *one-half of 1 per cent.* of the value of the contract price for the work to be done by any particular contractor; the period of maintenance is six months from completion, and the powers of the engineer in respect to interference with the contractor's workpeople are satisfactory.

The contractor must agree to pay the wages and to observe the hours of labour agreed upon and recognised by the trade union and local association of employers as fair for

the district in which the work is to be carried out. This can easily be accepted by all manufacturers of repute. As usual, however, in all specifications issued by this well-known firm, there is no provision for arbitration in cases of dispute, it being distinctly stated that, in the event of any disagreement, the decision of the engineers shall be final and binding upon all parties.

We do not consider such a stipulation just, and recommend that exception be taken to it by all firms tendering; as a matter of principle, it should be, as a final resort, open to either contractor or purchaser to appeal in case of a dispute, to an entirely independent authority, and no matter how eminent, or of what high standing any firm of consultants may be, by reason of the terms of their engagement to the purchasers, they cannot be entirely "independent" in the sense in which the word is used in this connection.

LEGAL.

Atkins & Applegarth *v.* Castner-Kellner Alkali Company, Limited.

Judgment in this action, which was to restrain infringement of the plaintiffs' patent, was given by Mr. Justice Buckley on Thursday, the 16th inst.

His Lordship said that the patent to which this action related was a patent, No. 20,768, of 1890, granted to the plaintiffs for improved means and apparatus for separating alkaline and earthy metals and other products from the salts of such metals, or from other substances containing them. The questions which he had to determine were first, whether these letters patent were valid; and secondly, if they were valid, whether the defendants had infringed them. The question of validity subdivides itself into questions of anticipation and utility. The process with which he had to deal was one in which a solution of sodium chloride in water is subjected to an electric current while in contact with mercury, with the result that the sodium in solution is precipitated into the mercury and forms an amalgam, while the chlorine is driven off in the form of gas. At the date of the plaintiffs' patent it was well known that when such a solution was subjected to electrolysis it was split up, the chlorine being liberated at the anode pole while the metal was liberated at the cathode pole of the cell in which the decomposition took place. And it was also well known that if the cathode was composed of mercury, sodium was driven into the mercury so as to form an amalgam. Further, it was known that by heating the sodium amalgam with water (although this was to some extent in question between the parties), or by further subjecting the amalgam in water to electricity, the sodium might be separated from the amalgam in the form of caustic. At the date of the plaintiffs' patent there existed patents of three persons which were pleaded by the defendants as anticipations. First, those of a man named Nolf, in 1882 and 1883. His process, shortly stated, was to use as a cathode a layer of mercury 1 centimetre in thickness lying at the bottom of the apparatus, and pass from carbon anodes a current of electricity through a salt solution so as to drive the sodium into and amalgamate it with the mercury, and periodically to receive the sodium in amalgam by opening the cock of a small tube at the bottom of the apparatus. He knew that it was necessary to remove the amalgam before it had become charged with too much sodium, and told them so to remove it. It was a process of electrolysis with a mercury cathode 1 centimetre in thickness, with periodic removal of the mercury when charged and not too highly charged with amalgam. The next was that of Petri, in 1886. His object was to obtain ferricyanide of potassium by electrolysis with a mercury cathode. The material point as regarded this patent was that the flow was to be or might be not intermittent as in Nolf, but continuous. The third was a patent of Donkin of 1888. His object was to obtain amalgam of sodium and quicksilver for the purpose of using it in the amalgamation of gold and other ores. He used an electrolytic cell of some non-conducting material with a layer of quicksilver on the bottom as a cathode. Above was a solution of chloride of sodium, and a carbon anode, and by electrolysis he caused the sodium to be absorbed by the mercury cathode. He described how by making cells and fixing pipes in the sides of the cell below the upper surface of the quicksilver, he could directly connect the main body of it to the quicksilver in an amalgamater, and cause a circulation of the quicksilver to and from the cell and the amalgamating device by means of a suitable pump. In this state of knowledge the plaintiffs' patent was granted in 1890. At page 30, lines 23 to 28 of their specification, they stated the knowledge which they admitted to have existed at that time, and went on to say that theretofore it had not been found possible, by which they meant, as appeared by what followed, industrially or commercially possible, to apply the electrolytic process to the purpose of separating metals from their salts, because as they said (but he thought erroneously) counter-electromotive force had been set up at the cathode by the metal and hydrogen to such an extent that the electromotive force required to effect the decomposition and deposit the metal in opposition to the electromotive force had been out of proportion to the industrial result obtained. This statement of the reason for the impossibility or difficulty which they alleged theretofore to have existed was, he was satisfied, erroneous. The counter-electromotive force was not the difficulty. It was constant, or nearly constant, being 3·2 of a volt at starting the process, and increasing by no more than ·02 of a volt for every additional one-tenth of 1 per cent. of sodium forced into the mercury. But the fact that the patentees misconceived and misstated the theory did not, he thought, invalidate their patent. Their theory might be wrong, but if their process and apparatus were right, their patent might be supported, notwithstanding their faulty theory. He passed on then to consider what, upon the true construction of their specification, was the invention which they claimed to have made. At the outset it was necessary to determine with exactness the meaning with which these patentees used the word "cathode." By derivation, cathode meant simply "way out," but in the language of electricians it had come in strictness to mean the first or earliest point at which the electricity got access to the way out. According to this strict definition, the cathode would be a point or a superficies, but electricians did not always use the word, and he was satisfied that these patentees did not use the word in the strict sense; what they meant by their cathode was not the superficies of the mercury or any superficies, nor was it the mercury apart from anything else. It was, in their language, a body of definite thickness and of composite character, composed partly of mercury and partly of a metal chamber or band supporting the mercury, or over which the mercury flowed. To show that this was so, he referred to a few places in the specification. They there spoke of the mercury flowing over the surface of the cathode which might or might not be itself amalgamated with mercury. They also spoke of the amalgam as moving while still forming a part of the cathode and of the metal being renewed continuously from the surface of the cathode. Then they spoke of retarding the descent of the mercury over the surface of the cathode. Other like passages might be referred to. That upon which the mercury was to be supported was always to be metal. The cathode in this patent was always either metal or mercury supported by metal. With a cathode, therefore, such as he had described, the patentees' object was as stated in the specification to provide means and apparatus for obtaining "on a practical scale" the metals without requiring "so great an amount of power" as would be required by the use of ordinary electrolytic apparatus. The emphatic words here were "on a practical scale," and without requiring "so great an amount of power." The object was to get on a practical scale that which they admitted could already be obtained on a scale not practical, and to obtain that with a saving of power. The essential points were a practical scale and economy, and if the patentees did not achieve those two results in a new way, or in fact, it appeared to him that their patent failed. Shortly stated, then, what was the process which they indicated? The process was one by which, with the use of such apparatus as they pointed out, the mercury whilst exposed to electrolytic action was to flow continuously. He could not find that they said that the process required that it should flow rapidly, or at such speed that it left the electrolytic chamber when it had attained a definite richness. Beyond the fact that the mercury was to flow at an undefined rate, there was nothing to indicate that it was to leave the cell while the percentage of sodium was still very small or of any defined amount. He could find only that it was to flow, and that it was to flow over metal. The patentees did not rely upon stirring or mixing with a view to homogeneity. Their point was continuous movement of the mercury cathode, with a view, not to mixing, but to removal from the electrolytic cell. And upon the question of rapidity of flow, he found that, so far from the patentees emphasising the necessity of speed, at page 4, line 24, of the mercury flowing "comparatively slowly," they indicated means which were to be, or might be, taken for the purpose of retardation. Then, for instance, at page 5, line 4, they told them that, to retard the descent of the mercury, the cathode might be made with horizontal corrugations, as shown in fig. 4, and that by this means the time of descent might be considerably prolonged. Again, at page 5, line 13, they told them that, in place of keeping fig. 1 in a vertical position, you might incline it at any desired angle. This would, of course, diminish the effective force of gravity, and produce some retardation. There was another consideration which pointed in the same direction. The plaintiffs provided for a porous partition, whose function was to prevent caustic, whose formation they contemplated on the cathode side of the partition, from reaching the anode. From this it was plain that they did not contemplate that the flow should be so rapid that caustic should not have had time to form before the flowing mercury and amalgam left the cell. The conclusion he drew was that the patentees did not know, and left the public to find out, whether speed was advantageous or injurious for the process which they described. They summed up the matter at page 5, line 35, by saying that any arrangements or apparatus which would allow of the use of a flowing or moving mercurial cathode might be employed. Their claims then were, first, for the improved means which consisted of using electrolysis in an apparatus, the cathode pole of which was composed more or less of flowing or moving mercury, or body of mercury, substantially as described; secondly, the method of employing mercury at the cathode pole, which consisted in causing the mercury to flow or move over, on, or with the surface of the cathode pole substantially as described; thirdly, constructing the cathode pole with means for causing a thin stream of mercury to flow over, on, or with the acting surface of the cathode pole, substantially as described and illustrated in the drawings. His Lordship thought that this was a claim for a process by which the patentees asserted that they could on a practical scale and with greater economy obtain the desired metal if flowing mercury was employed as the surface of the cathode, but he did not find that they knew or described the rate of discharge of the flowing mercury from the electrolytic cell which was necessary for success, either by indicating the speed at which it was to be

caused to flow, or by indicating at what point of richness of the amalgam the flowing cathode must be made to leave the cell. Pausing, then, he asked himself what in the process described was new to anything which Nolf, Petri, and Donkin had done? They had all by electrolysis formed amalgam of sodium and mercury, and they had all removed it from the cell in which it was obtained. Nolf removed it intermittently, Petri removed it continuously, Donkin had removed it either intermittently or continuously, he did not say which. The plaintiffs removed it continuously, but they did not say with what speed of continuity. He failed to find in the process which the plaintiffs claimed any new invention which was not found in the process previously described. He passed next to the question of utility. On this point he did not forget that which he learned in the Welsbach Company *v.* the New Incandescent Company, and there endeavoured to express; but the utility he had to investigate was not necessarily commercial utility or competitive utility, but utility for the purpose of the patent law. As regarded this patent, the essential utility consisted, in his judgment, of two things. First, that the patentees adopting a known process, undertook to show the public how to effect, on a practical scale, that which could be effected before, but not on a practical scale; and secondly, that the way they indicated should be one which effected an economy of power. Did the patentees show how to effect the object on a practical scale? Their object was to separate sodium—and sodium hydrate—from sodium chloride. They left it in doubt whether sodium or caustic was their principal product. It was plain that they intended to get sodium amalgam, and they expected to get caustic. But he would assume that they wanted to get the latter as well as the former, and not merely to get the former with a view to subsequently obtaining the latter from it. Did they obtain one or both on a practical scale, or to an extent greater than was attainable by methods previously described? The answer was in the negative. The efficiency of the plaintiffs' apparatus was about 50 per cent., and of this about one-half consisted of caustic, but caustic so mixed with brine as to be commercially of little or no value. The process of Donkin had an efficiency of about 90 per cent. It was plain that the patentees expected to get caustic in their electrolyte, for the very object of the porous partition was to prevent the caustic reaching the anode and from doing mischief. The plaintiffs' process, in his judgment, was not useful as indicating anything by which caustic could be obtained with greater efficiency than by previous methods. The next point was, did the patentees effect what they claimed, viz., a saving of electric power? He did not consider that question could be answered in the affirmative, and on these grounds he thought the defendants failed as regarded utility. Lastly, on the question as to infringement, his Lordship having described the apparatus used by the defendants, said that, assuming in the plaintiffs' favour that a patent for a continuous flow in one direction of mercury over a metal base was valid, the defendants did not adopt a continuous flow in one direction, they did not adopt a compound cathode of which some part was a metal base, but theirs was an apparatus of which it was the essence that the cathode should be mercury only, and that the base should be of a non-conducting material. In his judgment there was no infringement, and for these reasons he thought the plaintiffs' action failed, and he accordingly dismissed it, with costs.

River Plate Construction Company.

In the Chancery Division before Mr. Justice Farwell on Saturday, the matter of an arbitration between the River Plate Construction Company, Limited, James Capel & Co., and Charles Bright was heard.

Mr. C. E. E. Jenkins, K.C. (with whom was Mr. Schiller), said there were four applications by Mr. Bright, the first two of which were a motion to set aside the award or in the alternative to have it remitted; and secondly, an application to discharge the order making the award a rule of the Court. In a short preliminary statement, counsel said the story might be taken to start, for this purpose, with Mr. Charles Bright, who was a citizen of the United States, and who was the owner—in equity at all events—of the whole of the share capital of the company called La Sociédad Commercial de Monte Video. This company owned the tramways in Monte Video, the undertaking being worked by horse traction, and in addition to the usual assets accompanying such an undertaking, as horses, carriages, stations, and so forth, it had assets not connected with the tramways, the most important of which was an hotel. Mr. Bright having entered into the contract to purchase all the shares in the company, came over to England and entered into negotiation with certain financial groups with a view to turning this horse-traction tramway company into an electric traction undertaking; and, eventually, when all the work was done, a public company was formed to take over the undertaking, and he anticipated making a profit out of the transaction. In this connection he was introduced to a firm of brokers, Messrs. James Capel & Co., and a financial scheme was devised of this nature:—It involved the formation of two companies, one of which was formed, and one not yet formed. In order to get the necessary funds, they formed the River Plate Construction Company, Limited—which was a party to these proceedings—on August 10th, 1899, and it was registered in the usual way under the Companies' Acts. It had a capital of £120,000 in 1,200 ordinary shares of £100 each, and 1,200 deferred shares of 1s. each. The sum of £126,000 was to be provided by Messrs. Capel, which was to be applied in subscribing for shares in this Construction Company. Then the money, the actual cash, was to be applied in paying for the shares which Mr. Bright had agreed to buy in La Sociédad Commercial. Then the necessary steps were to be taken towards obtaining authority to turn this horse tramway into an electric tramway. Incidental to that arose questions as to the concession. There were in reality two concessions—one in perpetuity, and one for 50 and 25 years; but what the company aimed at was the consolidation of the two concessions into one concession for 75 years. When that was obtained, and the necessary work done for conversion into an electric undertaking, a large company would be formed which would take over the tramway undertaking; but not the other assets, the chief of which was the hotel. These somewhat elaborate arrangements were put into an agreement, which was entered into on August 10th, 1899, the parties to which were Mr. Bright, the Construction Company, and Messrs. Capel, the brokers. There seemed to be some dispute on the evidence whether, at the time when Mr. Bright signed it—he was the first person to sign it—and before he actually put his pen to it, the company had been registered or not. Counsel did not think it mattered whether it was registered then or later on; but the agreement had never been sealed by the company. Counsel read the agreement, and went on to remark that Mr. Bright went out to Uruguay to get from the municipality the consent to electric traction. The parties to the agreement were aware that the municipality had no power to grant a concession for such a length of time as 75 years.

Mr. Upjohn, K.C.: That is not admitted.

Mr. Jenkins proceeded to say that Mr. Bright succeeded in obtaining the concession for 75 years, and completed his contract on conditions which the other side admitted were satisfactory. The award of the arbitrator (Mr. Chadwyck Healey) directed Mr. Bright to pay to Messrs. Capel £60,000 as purchase money for shares to the like nominal amount in the Construction Company, being half the ordinary shares to the nominal value of £120,000 in the same company, and that Messrs. Capel should, on receipt of the £60,000, transfer to Mr. Bright ordinary shares to the nominal value of £60,000 as fully paid, and that such transfer should forthwith be registered by the Construction Company. Counsel argued that the arbitrator had not properly determined the matters in dispute, and that the award should therefore be remitted.

His Lordship, without calling on Mr. Upjohn (who with Mr. Hume Williams, K.C., and Mr. MacSwinney represented the other parties) refused the application, defending the propriety of the course taken by the arbitrator in a 35 days' hearing. He also dismissed the second motion to declare the award void on the ground of uncertainty, and the third and fourth motions that he had not properly heard and determined the matter in dispute, or that the award was bad on the ground of ambiguity. It was not for his Lordship to say that the arbitrator should have accepted evidence from a Uruguayan lawyer. Even if he made a mistake in this respect, it was no ground for setting aside the award.

Mr. Jenkins said he would like time for Mr. Bright to consider whether he should take the matter further.

His Lordship said that as it was a matter of £60,000 to Mr. Bright, he would give leave to appeal.

The Chloride Electrical Storage Syndicate, Limited *v.* Fitch.

In the Chancery Division of the High Court of Justice on Saturday, before Mr. Justice Cozens-Hardy, Mr. S. Smith, on behalf of the plaintiff company, applied for an injunction in this action to restrain the use by the defendant of a secondary battery in an electric launch running on the Thames, which it was contended was made in breach of the Rhodin patents. The plaintiff company owned the English rights of these patents, and the battery made under them was known as the "R plate battery." The defendant, for whom Mr. Fitch appeared, had bought the battery, not knowing that it was an infringement, or that it was not made by the English owners of the patent. The defendant consented to an order against him, which his Lordship made.

Electrolytic Plating Apparatus Company, Limited, *v.* Henry Holland & Co.

On Tuesday last Mr. Colefax mentioned this case to Mr. Justice Grantham in the King's Bench Division. He said it stood 50 out of that day's non-jury list, and his application was that a day should be fixed for the hearing of the case, inasmuch as it was a very important patent action that would take a great length of time, there being many witnesses to call.

His Lordship said it was of no use asking him to fix a particular day for the hearing, because the case could not be reached this side of the Whitsuntide vacation.

Mr. Colefax said he would be glad if his Lordship would fix June 13th for the hearing. At any rate, he hoped it would not be heard before June 13th.

His Lordship said he did not think he could do that, but would allow the learned counsel to have an opportunity of making an application later on.

Austria.—Felten & Guilleaume, Fabrik Electrischer Kabel, Stahl & Kupferwerks Gesellschaft is the name of a company which has just been formed in Vienna with a capital of 6,000,000 kroner.

PARLIAMENTARY COMMITTEES.

Derbyshire and Nottingham Electric Power Bill.

The Select Committee of the House of Commons, under the chairmanship of Sir Wm. Houldsworth, which has had various electric power Bills referred to it for consideration, last week considered the Derbyshire and Nottinghamshire Electric Power Bill. The petitioners against the Bill were the Derbyshire County Council, the Derby Corporation, Mansfield Corporation, Chesterfield Corporation, Worksop Corporation, Derwent Valley Water Board, and the Urban District Councils of Alfreton, Baslow, Belper, Eastwood, Heanor, Matlock, Matlock Bath, North Darley, Worksworth, and Hucknall Torkard.

Mr. Pember, K.C., who, with Mr. Russell, K.C., Mr. Egerton Bridges, and Mr. A. V. Frere, represented the promoters, said that the scheme embraced the whole of the counties of Nottinghamshire and Derbyshire with the exception of an area south of the river Trent, and except that part of Derbyshire which lay to the north-west of the boundary between the Unions of Bakewell and Chapel-en-le-Frith. The Bill was promoted by the great manufacturers of the district, and was framed on very similar lines to the South Wales Power Bill of last session. The proposed capital was £1,800,000 share capital and £600,000 borrowing powers, and they had a list of manufacturers supporting the scheme, numbering some 400, and whose business involved a capital of some 20 millions. The district proposed to be supplied had an area of 1,570 square miles, with a population of over 1,000,000, and including nearly 600 works, including pits. There were a great number of local authorities in the district, but only three were at present in the position to supply electric power, although 11 of them had the power to do so. The total area of these three districts was 31 miles, but they were only in a position to supply 10 miles. The other eight local authorities with power to supply had an area between them embracing 97 square miles, so that the Committee would see that in the area proposed by the promoters there were 1,473 square miles totally unprovided with facilities for obtaining electric power. In several cases the promoters had made arrangements with the local authorities who consequently were not opposing the Bill. It was proposed to erect generating stations at Colwick, Trowell, Newbold, and Warsop. It was believed that there were many decaying industries now carried on by hand which would be revived if there was a supply of cheap electrical power. They had nearly 200 petitions from public bodies in support of the scheme. The present Bill presented great points of difference to the General Power Distribution Bill of 1898, which was promoted by a group of American speculators, because then nearly all the villages were opposed to it, whereas now they had most of the villages with them. Arrangements had been made with many local authorities. Nottingham had seen the advantage of taking the electricity from the promoters in bulk, instead of embarking on a large capital expenditure, although the Corporation already had an electric installation on which they had spent £178,000. Retford and Mansfield had been arranged with, and Ilkeston would take a supply in bulk. With regard to the opposition of Chesterfield, the Corporation had only powers to expend £25,000 on an electric light scheme, and their rates were 7s. in the pound, while they had a Bill before Parliament to spend £200,000 on municipal purposes. On the other hand, the ratepayers supported the company's proposal to supply Chesterfield in bulk. The petition of the Derby Corporation stated that the Corporation had spent £120,000 on their electricity undertaking, and had laid 13 miles of mains. The company, however, would prove that they could supply at a cheaper rate than the Corporation, and he contended that the Corporation had no right to set up a monopoly for the supply of electrical power. They had failed to bring about an agreement with the Derbyshire County Council, but he could not see why that Council could not accept the same clause as had been agreed with between the promoters and the Nottingham Corporation. With respect to the opposition of various urban councils, they wanted an absolute veto, and that the promoters could not agree to. As to the petition of the Worksop Corporation, the Corporation were only empowered to raise £15,700 for their electrical undertaking, and consequently would only be able to supply current for lighting within the town.

Mr. J. Swinburne, C.E., was called for the promoters, and said the scheme was a very simple one. It was intended that steam engines should drive the dynamos at first, but probably gas would be used later on. He considered the area of supply well chosen from the point of view of fuel and meters. He believed that the large firms in England which had put down large installations would never have done so if such schemes as the one being considered had been proposed earlier. Witness proceeded to describe in detail the situation of the proposed generating stations.

Mr. Keen, representing the Chesterfield Corporation, intimated to the Committee that an agreement had been entered into with the promoter of the Bill, and that therefore they no longer opposed the preamble.

Mr. Russell said that Chesterfield had been given a similar clause to Mansfield.

Mr. Swinburne, in further evidence, expressed his belief that the company would be able to supply electric power at a cheap rate and certainly at a cheaper rate than a local authority because the local authorities would not possess the same facilities for supplying.

In cross-examination by Mr. Acworth (who represented the Derby Corporation), Witness said that he was not aware that Derby had got a 3,000-kw. scheme, but if they had it would be getting on to what he would call an economic scheme. If Derby supplied energy for motor purposes at 1½d. per unit, he considered that very good. He thought it would pay Derby to take its supply in bulk from the promoters.

The Duke of Newcastle, who owns large estates in Nottingham, gave evidence in support of the Bill. Difficulties had been experienced in establishing factories in districts owned by him, and he considered the supply of electric power would bring about the establishment of factories.

Mr. Arnold Lupton, C.E., gave evidence to the effect that the district intended to be supplied was a very suitable one for such a scheme, and the sites for the generating stations were favourably situated for the cheap production of electrical energy. It was intended to provide 60,000 E.H.P., allowing 10 per cent. extra for spare plant, mains, &c., and providing for a loss of 15 per cent. in transmission. He estimated that the land, levelling, walling, roads, preliminary and Parliamentary expenses in connection with the scheme would be £60,000; buildings of all kinds connected with boilers, chimneys, flues, engine houses, foundations, roofs, workshops, offices, store rooms, stores and sub-stations at £216,000; engines, air pumps, condensers, steam pipes, dynamos, switches, gauges, transformers, telephones, &c., at £801,000; boilers, superheaters, economisers, gas producers, cranes, coil hoists, tips, sidings, &c., at £300,000; electric mains and transformers at £783,000; floating capital, engineering contingencies, and reserve borrowing powers, at £240,000; a total of £2,400,000.

At this point it was announced that the Worksop Corporation had settled with the promoters, and that consequently their opposition was withdrawn.

Mr. Lupton's evidence was continued, and in cross-examination said the Derby scale of charges to small consumers, which was 1½d. per unit, was a liberal one. He must admit that a consumer would have to take 300 H.P. from the company to allow the company to successfully compete with the Derby Corporation.

Mr. Maurice Deacon, President of the Midland Institute of Mining Engineers, supported the Bill, and he considered that the adoption of electrical energy for collieries would be of great value. He had been responsible for putting down plant at collieries and other places at a capital expenditure of £80,000, and the plant never would have been put down had such a scheme as the present one been in existence.

Replying to the Chairman, Witness said that he was going to take power from the company, but, of course, where he already had plant installed he should continue to use it.

Mr. M. H. Mills, one of the promoters, said that all the promoters were largely interested in the district. There was great disappointment felt in the district when the General Power Bill of 1898 was defeated; the colliery owners felt that such a scheme was necessary. The reason why Derby was included in the present Bill, and not in the Bill of 1898, was because Parliament and the country had become more enlightened since 1898. He considered that it would be an advantage to Derby to come into the scheme, and take electricity in bulk from the company, because he thought that Derby would not be prepared to supply all the electricity which would be required.

Further local evidence was called in support of the Bill.

Mr. B. Bainbridge, who was connected with a large number of commercial undertakings in the district, expressed the opinion that it would pay colliery proprietors to sell their electrical plant, and take power from the company, the limits of the supply under the scheme were within a mile of Sheffield, but he thought if the Bill passed, some of the smaller Sheffield manufacturers would come into the area of supply for the purpose of getting cheap electrical power, because they would not only get cheap power, but they would also get cheap rates.

Mr. Hooley, M.I.C.E., on behalf of the Parliamentary Committee of the Notts County Council, said the Bill had the warm approval of the Council, and personally he knew of nothing better calculated to keep the numerous industries in the county than the scheme.

Mr. T. Hepworth, engineer to Messrs. Bemrose & Co., Limited, printers of Derby, said his firm was in favour of the Bill. They had put in their own electric installation, but when they wanted more electricity they would go to the company. Five years ago the Corporation offered to supply them with power at 3d. per unit, but they considered that prohibitive. They would have no objection to taking power from the Corporation at 1½d. per unit.

Mr. Russell, K.C., at this point, said the promoters had come to terms with the Derby Corporation. With regard to Nottingham, they had agreed not to exercise their powers in that town except for laying mains to supply to districts beyond, and they were prepared to do the same with regard to Derby.

The Chairman: The Committee understand then that you cut Derby out?

Mr. Russell said they would not exercise any powers under the the Act except for laying mains through the town.

The Chairman said they took it that Derby and Nottingham in a similar way as certain towns were exempted from the South Wales Bill.

After further discussion, the Chairman said the Committee had made up their minds to pass the preamble of the Bill.

Mr. Acworth, for the Derby Corporation, asked for a clause to protect the gas meter and electric mains from electrolysis. He submitted that it was a case for putting in a stronger clause than the Board of Trade clause.

Similar applications were made on behalf of the Corporations of Mansfield and Chesterfield.

Mr. Bridges, replying to the Chairman, said the promoters considered the petitioners had all the protection that was necessary for the general law.

The Committee refused to allow any special clause, as they considered that petitioners were fully protected by the general law.

A number of general clauses were submitted and approved with-

out opposition being offered, but the following addition was made to clause 44:—"The company may charge for a supply of energy to authorised undertakers or persons supplied to them either by the actual amount of energy so supplied or by the electrical quantity contained in the supply, or by such methods as may be agreed between the company and such undertakers or persons."

A clause was submitted to empower the company to lay mains under railways and tramways without making in each instance a special application to the Board of Trade.

This was approved, and the Bill ordered to be reported for third reading.

Metropolitan Electric Supply Company, Limited.

A Select Committee of the House of Commons, presided over by Sir H. Fletcher, last week had before it the Bill of the Metropolitan Electric Supply Company, Limited. Under the Bill the company sought to obtain further powers with respect to the supply of electrical energy and for other purposes. Mr. Balfour Browne, K.C., Mr. Fitzgerald, K.C., and Mr. Moon appeared for the promoting company. Petitions against the Bill were lodged by the Middlesex County Council, the Borough of Paddington, the Willesden Urban District Council, and the West Middlesex Water Company.

Mr. Balfour Browne, in opening the case for the petitioners, said that its object was simply to carry out an order of the Board of Trade, which was dated April 24th, 1900. Under that order the Board of Trade consented to an "extra high pressure" being given by the company, but they made a condition that at least two separate and distinct trunk mains should be laid to each of their distributing stations, and that the new cable should, if practicable, run along a new route. Their present cable ran along the south side of the towing-path of the Grand Junction Canal to the areas of supply, which included the districts of Paddington, Marylebone, St. Giles's, Holborn and the Strand. The conduits would be underground. The chief opposition to the present proposal came from the district councils of Willesden and Paddington, who objected to powers being given to his clients to open up the streets for the purpose of laying their mains. That principle had, however, been settled by a Select Committee of Parliament, which had carefully considered the question, and had come to the conclusion that in cases where a company's generating station was beyond their district of supply, they should have the necessary powers of breaking up the street in order to get their electricity to their supply areas. When the company proposed to lay their first conduit, they intended to lay it underground; but having come to an agreement with the Canal Company, they laid it under the towing-path of their canal, which, of course, was private property. They could not carry their second conduit alongside the present, because the Board of Trade insisted that it should be carried along an altogether different route. But even if that were not the case he understood there were physical difficulties against so doing. It was very important that this additional cable should be laid, because in the event of anything happening to the existing conduit the company would not be able to continue their supply.

Evidence was then given by Mr. John Conacher, the general manager of the company. He said that up to the end of last year they had spent £262,286 on their Willesden works, and they were now enlarging them at a cost of £85,000. If the present Bill passed they would have to provide for additional trunk lines which would cost £80,000. The areas which they served were very rapidly developing, and they must have increased power of generating if they were to keep up with the demand. Under the regulations of the Board of Trade each main could only carry 1,000 kw. of electricity, but they were endeavouring to get the Board to increase that amount by one-half and make it 1,500. Their present conduit along the Grand Junction Canal provided for eight mains carrying 1,000 kw. each, but if the Board of Trade would allow them to increase them to 1,500 kw., those mains would more than meet all their requirements down to 1904. If they had to go on as at present, he was afraid their main capacity would be exhausted by the end of next year. There could be no doubt that the conduits along the canal were open to serious dangers from the barge traffic, &c, and if through some accident the mains were rendered useless the whole of the company's area of supply would be in darkness. Willesden objected to their breaking up the streets, but they would not be put in any worse position in that respect than any other local authority, excepting that the company would break up the streets without providing electricity.

Mr. Harper (representing the Middlesex County Council) said he was glad to be able to inform the Committee that he had come to satisfactory terms with the company, which would save his opposing the Bill any longer.

Mr. Conacher, in cross-examination, said it was not possible to take the new conduit along the north side of the canal, as that was covered with wharves and buildings.

Replying to Mr. Allan, who represented the borough of Paddington, Witness said that the company, in taking a new area in that borough, considered that they were conferring a benefit on the district. He was aware that they had not been requested to take the area, and he did not think it would be a very valuable area to them, as it was covered with artisan's dwellings.

In answer to Mr. Greig, for the Willesden Urban District Council, Witness said it was the Board of Trade who had suggested the alternative route, and not the company.

Mr. Frank Bailey, C.E., replying to Mr. Moon, said he was a director of the promoting company, and at the time they obtained their Act, they were authorised to establish a generating station at Willesden. In his capacity as engineer to the company, he prepared the plans for that station, but at that time they had not foreseen anything like the demand which now existed for electrical energy. When they started, they reckoned that the conduit which they had laid alongside the towing-path of the Grand Junction Canal would suffice to meet their requirements for a long time. It was true that when they promoted their Bill in 1898, two routes were proposed—one underneath the roads and another along the canal bank—but it was not intended to have the two routes. They were simply put forward as alternative routes. As they were able to come to a satisfactory arrangement with the Canal Company, they decided to adopt that route, and they therefore withdrew the road route. If they could get another route alongside the canal, it would be much cheaper than the road route, but he was quite satisfied that another conduit alongside the canal was quite impossible and out of the question. He did not know of any other route than the one they were now seeking powers to obtain.

Cross-examined, the Witness said it was quite true that they had not had any accident along the canal route, excepting in one case where a bargee put a marling-spike through the mains.

Replying to the Chairman, Witness said he had considered the possibility of laying the additional main on the south side of the canal, but he was convinced that it could not be done. There was the difficulty of the railways, and also at Kensal Green there were gasworks and houses which would render it impossible to take the main by that route.

Mr. Fitzgerald said he was authorised to say that the promoters would be quite willing to meet any reasonable objection of the petitioners, and they were prepared to refer the whole matter to the Board of Trade. He would remind the Committee that powers similar to those now asked for had been granted to companies in recent electric power Bills. It had been decided that if the local authority objected to the route which the company proposed and suggested an alternative route, that route should be adopted if the Board of Trade were of opinion that it was reasonable.

The Chairman said the Committee had received a letter from the Board of Trade, in which they said that they would advise that it was highly desirable that mains should be laid along the second route.

Major Cardew, R.E., consulting engineer, was then examined, and replying to Mr. Fitzgerald, he said he had considered the proposals in the Bill and was of opinion that the company ought to have the powers they asked for. In his opinion it was highly desirable that in a case like the present the generating station should be away from London and outside the area of supply. There were great objections to having a generating station along the route of supply, involving as it would a large amount of objectionable traffic on the roads. It was very important that the company should have this additional conduit, because in the event of anything happening to their existing main the supply of current would be stopped, and that would be a very serious matter for the districts which the company supplied. The view which the Board of Trade took in respect to trunk lines was that if there was more than one, they should be laid along different routes.

This concluded the evidence on behalf of the Bill, and counsel then addressed the Committee in opposition to the Bill; Mr. Greig, on behalf of Willesden, pointing out that the Urban District Council themselves intended to lay down electric mains along the very route chosen by the company.

The Chairman, in giving his decision, said the Committee had come to the conclusion that the preamble of the Bill had been proved, but there was one provision, which must be introduced in some form, which was that the towing-path route alongside the Canal was not to be abandoned without the consent of the Board of Trade, the Board of Trade having laid down very strongly that the two routes were necessary. The company was also to be subject to the agreement come to with Paddington.

Mr. Fitzgerald said that, on behalf of the promoters, he wished to say that they never had the least intention of abandoning the Canal route.

Manchester and Liverpool Electric Express Railway.

On the Select Committee considering the Bill for the Express Railway between Liverpool and Manchester resuming its sitting on 15th inst., Mr. Stephen Sellon, the chief engineer of the British Electric Traction Company, was called, and said he represented £3,500,000 of the £18,000,000 of capital invested in this country in electrical undertakings. He had carefully examined the scheme now before the Committee, and considered it crude and impracticable, fanciful and doubtful, and as absolutely valueless for the purpose for which it was intended. A system of electric traction could be established on any of the existing railways between Liverpool and Manchester at a capital expenditure of between £180,000 and £200,000. With the high speed contemplated by Mr. Behr, and the small curves shown on the drawings, he was clearly of opinion that the action due to the centrifugal force would be sufficient to turn over the whole structure on which the monorail was laid. As far as he could gather no allowance whatever had been made for the difficulties due to the expansion of the metals. He could not agree with Mr. Behr's theory that the breaking of an axle on his car would be of no consequence to the running of his train. The result would be the decapitating of the passengers or some other consequence of a serious character. As to the car, it occurred to him that being in two pieces, jointed only at the top, the tendency would be for it to open out and fly off in opposite directions as it was going round a curve at considerable velocity. In his opinion, Mr. Behr's figure of a train resistance of 30 tons was very much under-estimated. He was inclined to put the resistance at 80 tons, and if this were correct the working

expenses would not be £65,000 a year, as estimated by the promoters, but £120,000. If the railway took 50 per cent. more passengers than all the other railway companies put together, it would be only just sufficient to pay the working expenses.

In reply to Mr. FITZGERALD, WITNESS said he had not heard that it was proposed to equip any of the existing railways on this route with electric traction. He admitted that the Board of Trade was a competent tribunal to secure provisions for the safety of the public.

Mr. CHAS. ASHLEY CARUS-WILSON, consulting engineer, of London, and formerly professor of electrical engineering at the McGill University, Montreal, examined in detail proposed of the new railway, and expressed the opinion that with the space at his command, Mr. Behr would be unable to place on the car motors of sufficient power to attain the high speed contemplated. The only way in which it could be done would be to push up the motors into the bottom of the car, and that would alter the centre of gravity from below to above the rail. It was one of the fundamental propositions of Mr. Behr that he could keep the centre of gravity below the running rail. If he could do that the car would not topple over, but that was not the only cause of accidents. What happened was that the flange of the driving wheel mounted the rail on a curve, and this was not provided for at all. The limit of safety was determined by the amount of force on the flange of the driving wheel, and he was convinced that in running round a curve of 25 chains radius at a speed of 83 miles an hour on the experimental railway at Brussels, Mr. Behr had reached the full limit of safety. He did not see how the car could fail to come off the rails if it was run at a speed of 110 miles an hour round curves of the radius proposed in the Bill. As to braking power he believed that under the most favourable conditions this train could not be brought to a stand in a shorter distance than 1,944 yards, or just over a mile in one minute.

In cross-examination by Mr. BLENNERHASSETT (for the promoters), WITNESS said that he did not agree that because there were no switches or junctions, &c., that braking power was unimportant.

Sir WILLIAM POLLETT, general manager of the Great Eastern Railway, was called for the Cheshire Line Committee, and gave evidence as to the large amount of capital which had been expended on the Cheshire line. He contended that the line fully met the demands, and that, as a matter of fact, they could easily put on more lines if they were required.

In cross-examination, WITNESS said that while he believed the mono-rail would be a financial failure, at the same time it would seriously injure the Cheshire line.

On 16th inst. Mr. C. STEEL, the manager of the Great Northern Railway, gave evidence as to the admirable facilities at present given by railways.

In cross-examination, WITNESS expressed the belief that the public would not subscribe to the undertaking of the mono-rail, but there were certain financial speculators behind it.

Evidence of a similar character to the preceding two witnesses having been heard,

Mr. POPE, K.C., addressed the Committee on behalf of the London and North-Western Railway and Lancashire and Yorkshire Railway Companies. He maintained that unless the great public want of an improved service were shown, it would be a great hardship to deprive these companies of any of the advantages which were the result of their large expenditure and their careful nursing of the district. Admittedly Mr. Behr's scheme was a commercial experiment, and should only be allowed upon condition that the least possible injury was done to any other interest affected. The Committee would have to determine whether every precaution in this direction had been taken, and he submitted that the risk of injury to others was greater than any advantage that could be gained from this experiment.

Mr. LITTLER, K.C., for the Cheshire Lines Committee, argued that the weight of expert evidence was against the feasibility of the scheme. He pointed out that the Board of Trade could not prescribe the speed to be run, the radius of the curves, or the design of the car, and therefore, the Committee must not be cajoled into passing the Bill on the plea that all questions of public safety could be left with that department. The Committee could not protect the Cheshire lines or the public except by rejecting the Bill.

Mr. BALFOUR BROWNE, K.C., replying for the promoters, said he would not try to beguile or cajole the Committee, but would ask them to pass the Bill, in the interests of the public. It was contended that this was a bubble scheme, but if that were so, one would naturally have supposed that the great towns like Manchester, Liverpool, and Warrington, would have opposed it. So far from that being the case, Manchester and Liverpool had sent some of their most representative men to give evidence in support of the scheme. He protested against the idea that railway companies had a vested right in the traffic of the country. If they served the public well, the public would use their undertakings. If they served them badly, others had a right to take their place, and if more rapid means of communication than those furnished by the existing railways could be provided, the existing railways must stand aside.

On the 17th inst. the Committee sat for some time in private, and on the public being admitted, the CHAIRMAN announced that the Committee had decided to pass the preamble of the Bill.

Late on Friday afternoon the Committee considered the clauses of the Bill submitted to them, the principal clause being that having reference to the centre of gravity of the car being below the top rail when the car was fully loaded.

Clause 56 of the Bill was amended by the following addition:—"And the cars or other vehicles to be used on the railway shall be constructed so that when the car or other vehicle is fully loaded, the centre of gravity shall be at least 12 in. below the upper surface of the uppermost rail."

The Bill was reported for third reading.

GATESHEAD AND DISTRICT TRAMWAYS

LORD MORLEY'S Committee of the House of Lords on Unopposed Bills on Monday had before them the Bill of the Gateshead and District Tramway Company, in which the company was authorised to raise additional capital. By their Act of 1899, the company was authorised to raise capital to the extent of £80,000, but such sums was not sufficient to enable them to carry out their powers under that Bill. Under this Bill power is taken to raise £60,000 additional capital.

SWINDON TRAMWAYS.

ON Monday the Examiner of the House of Lords considered the Act confirming the provisional order of the Board of Trade granting powers to the Swindon Corporation to construct and work tramways, for proof of compliance with Standing Orders. All the tramways are within the borough. No. 1 is 4 miles 6·80 chains in length; No. 2, 1 mile 4 furlongs 5·55 chains; No. 3, 3 furlongs 5·10 chains; No. 4, 1 mile 1 furlong 0·9 chains; No. 5, 6 furlongs 6 chains; and No. 6, 7·10 chains. The Bill was ordered to be reported.

ROYTON TRAMWAYS.

AN Act to confirm the provisional order enabling the Royton Urban District Council to construct tramways was before the Examiner of the House of Lords on Monday. The Act states that until the purchase of the existing tramways by the promoters they shall not construct junctions or otherwise interfere with any tramway in Rochdale Road, Oldham Road, or Dogford Road, except with the previous consent in writing of the Bury, Rochdale and Oldham Tramway Company, Limited.

BIRKDALE TRAMWAYS.

THE Bill to confirm the provisional order to the Birkdale Urban District Council for the construction of tramways was passed by the Examiner of the House of Lords on Monday. The whole of the tramways are to be constructed within the area of the Council. Three lines of tramway were scheduled, and the Council are given power to erect an electricity generating station on certain land acquired. A clause deals with the running of workmen's cars at certain times of the day, at maximum fares not exceeding ½d. per mile.

DUBLIN:—ST. JAMES GATE BREWERY TRAMWAY.

ON Monday the above Act passed the Examiner in the House of Lords, the Bill authorises Messrs. Guinness, Son & Co., Limited, to construct tramways in the City of Dublin in connection with the St. James Gate Brewery, and to work the same, and their existing tramways by mechanical power. Mainly the tramways will be constructed on the company's own property, but there are several street crossings authorised.

CROMPTON TRAMWAYS.

THE Examiner of the House of Lords passed on Monday the Bill confirming the provisional order of the Board of Trade to the Crompton Urban District Council, authorising them to construct tramways within their own district and work the same by mechanical traction. The Bill contained clauses for the protection of the Lancashire and Yorkshire Railway Company and of the gas and water mains of the Oldham Corporation.

BURY CORPORATION TRAMWAYS.

THE Bury Corporation Tramways Bill came before Lord Morley's Committee of the House of Lords on Unopposed Bills on Monday, and proofs of compliance with Standing Orders having been submitted, the Bill was ordered to be reported for third reading. The Bill authorises the Corporation to construct additional tramways at an estimated cost of £132,000, the additional electricity works requiring another £39,000. There are 25 new sections of tramways proposed to be made, but all are of short lengths and cover only about three miles altogether. The only portions outside the borough are in the districts of Tottington, Unsworth, and Whitefield. There is also power by the Bill for the Corporation to supply electrical energy outside the borough.

WREXHAM TRAMWAYS.

THE Examiner of the House of Lords passed the Confirmation Bill of the provisional order to the Wrexham District Council amending the Council's order of 1899 in several respects.

Leamington Tramways.

A Provisional Order to authorise an alteration of the gauge of so much of the tramways of the Leamington and Warwick Tramways and Omnibus Company, Limited, as are situate in the Borough of Leamington, and to work the same by mechanical traction, came before the Examiner of the House of Lords on Monday, and was ordered to go forward. The Bill contains clauses that no mechanical power other than electrical power shall be used upon the tramways without the consent in writing of the Corporation, and further, that notwithstanding anything in the orders of 1879 or 1882, or the Tramways Act of 1870, if the promoters shall within the period of three years from the date of the Order, adapt the tramways for working by mechanical power, the powers of purchase by the local authority shall not be exercisable until the expiration of 35 years from August 6th, 1900.

Blackpool Corporation Bill.

The Omnibus Bill of the Blackpool Corporation was before a Select Committee of the House of Commons, presided over by Mr. Bell, on Wednesday, Thursday, and Friday last week. Amongst the proposals in the Bill was one for the extension of the tramway from Waterloo Drive along Middle Lane to the borough boundary at Squires Gate Lane, and this was opposed by the Blackpool, St. Anne's and Lytham Tramways Company on the ground that this tramway running parallel to Lytham Road was intended to compete with the line leased by the Corporation to that company, and would intercept and divert traffic from the company's line.

Mr. Freeman, K.C., opened the case for the Corporation, and explained with reference to the tramways part of the Bill that practically the whole of the tram service was owned and worked by the Corporation on the overhead trolley system. There were, however, two pieces of line leased to companies. It was an undoubted fact that tramways paid when they went nowhere, and people liked a cheap ride. Although it had been stated that the Corporation tramway scheme would not be financially satisfactory, yet, as a matter of fact, it had been a great success. Altogether the proposed extensions were 11¾ miles, and the cost of construction would be £55,000.

Mr. Alderman Smith, Mayor of Blackpool, gave evidence in support of the Bill, and said it was not proposed to carry the tramway beyond the boundry of the borough. He believed that there was a project for carrying the Blackpool, St. Anne's and Lytham Company's line to Preston.

Mr. Alderman Kingsbury gave evidence as to the advantages attending the development of the tramways.

Other evidence having been given in support of the Bill,

Mr. Ackworth, on behalf of certain ratepayers, urged that the policy of tramway extension was being pushed to a reckless extent, and thought the Committee should pause before allowing the Corporation to go in for further expenditure.

Mr. L. Slattery, the manager of the Blackpool, St. Anne's and Lytham Tramways Company, stated that the company had recently obtained powers to double their line, and to substitute electric traction. The proposals of the Corporation would directly compete with the line, and the company had only a limited time in which to recoup themselves for their expenditure.

Mr. J. Fell, a director of the company, gave similar evidence.

The Committee decided to pass the preamble of the Bill.

Yorkshire Electric Power Bill.

On the Select Committee of Sir William Houldsworth resuming its consideration of the Yorkshire Electric Power Bill, the examination of Mr. A. G. Lupton, chairman of the syndicate promoting the Bill, was continued.

In cross-examination by Mr. Waugh, who represented the Corporation of Bradford, Witness denied that there was any understanding that the undertaking would be sold if sanctioned by Parliament, although the subject had been discussed. It was not a fact that each person was to take out double the amount of capital he subscribed as a member of the syndicate. He thought that a company would be willing to work with a capital of over £300,000 for a surplus of £2,000 after paying interest at 3 per cent.

Mr. Waugh asked the Witness if he was aware that the Bradford Corporation worked their electric department upon the lowest cost for production of any place in the kingdom, and that they supplied the tramways company at 1d. per unit.

Witness said he was not aware of the fact, but he thought that his company could sell at less, and would supply the local authorities at ¾d. per unit.

In answer to Mr. Horace Marshall, who represented Messrs. H. Biggs & Co., colliery proprietors, of Methley, Witness said he did not see that there was so strong a case for supplying that colliery with electricity at the same price as they proposed to charge railway and canal companies.

Mr. Pember, addressing the Committee on behalf of the promoters, said it was important that the point as to any sale of the undertaking which had been raised by Mr. Waugh should be cleared up at once, and he would ask the Witness if there was any such intention.

The Witness replied that there was none whatever.

Mr. Pember said the syndicate had been formed for the purpose of promoting the Bill, and subscriptions had been invited to defray the costs, and it was a limited liability among the members of the syndicate. The moment the Bill was passed the syndicate would pass away and the public would be asked to subscribe, and a company would be formed in the ordinary way.

The Chairman said he understood the meaning of counsel.

In reply to Mr. Pember, Witness said the policy of the board was to have no one connected with it who was professionally connected with the company, and nobody up to the present time had subscribed more than £300. The desire which animated the members of the syndicate was that of helping the local industries, and if the Bill was passed there would be no question of bargaining, but the public would be invited to subscribe in an open way. With regard to the House-to-House Company, at Leeds, there was no compulsion on the Leeds Corporation to buy that undertaking, and it was only when the undertaking became a profitable one that the Corporation exercised its right of pre-emption. Practically, the whole of the members of the syndicate were connected with the industries of the West Riding.

Mr. W. Chesterman, chairman of Messrs. J. Chesterman & Co., Limited, of Sheffield, and a member of the Council of the Sheffield Chamber of Commerce, stated that, after consideration, the Council of the Chamber of Commerce had adopted the Bill before the Committee, and he was authorised to come and give evidence in support of it. Sheffield severely felt the effect of foreign competition, and it was undoubtedly desirable that the introduction of electrical power in the way proposed should be sanctioned. He did not think that the Bill would interfere with the local authorities, except in the way that it would be the means of keeping them up to the mark. At present the local authority was not in a position to supply electrical power, except to a very limited extent, and there was bound to be a very considerable demand made to the company if the scheme was approved of by Parliament. It was his opinion that by the scheme it would be possible for the company to supply power at a cheaper rate than the municipal authority.

In cross-examination by Mr. G. Fitzgerald, counsel for the Corporation of Sheffield, Witness expressed the opinion that the clause in the Bill protecting Sheffield was quite adequate. He was unaware of the fact that Sheffield was ready to supply power at 2d. per unit, and he had no wish to say that the Corporation was not doing its best to develop its electrical undertaking. At the same time, he did think it was better for the local industries to have two strings to their bow. He could not name anyone who had asked the Corporation to supply them and who had been refused, but he thought that railways and canals were quite outside the scope of supply of a Corporation.

Answering Mr. H. Lloyd, Witness said the Council of the Sheffield Chamber of Commerce had also considered the South Yorkshire Electric Power Bill, but they came to the conclusion that the Yorkshire Electric Power Bill was the better of the two. There was no doubt that they were influenced in that decision by the fact that the promoters were local men.

Mr. W. B. Burdekin, secretary of Messrs. T. Jessop & Sons, Sheffield, supported the Bill, and said that since the rejection of the General Power Bill in 1898 the firm had put down their own electrical plant. They would have saved the capital expenditure which this involved had the General Power Bill gone through. He was not in favour of municipal trading, but he believed under the present Bill the interests of the Sheffield Corporation were adequately protected.

Other evidence of a similar character was called in support of the Bill.

Mr. S. Ward, the chairman of the brewery firm of Messrs. S. H. Ward & Co., of Sheffield, stated that they had made an application to the Sheffield Corporation for a supply of electrical power, but they were not satisfied with the price. He would like Sheffield included in the Bill, for he was not in favour of municipal trading, and did not care to have to rely on the local authority.

The Chairman said the Committee would like further information on one or two points. They were not quite clear as to whether Bradford, Leeds and Sheffield were absolutely excluded from the South Yorkshire area of supply.

Mr. J. D. Fitzgerald, K.C., representing the South Yorkshire Bill (the rival scheme), said they had not taken power to exercise all the powers of the Act within any of the county boroughs within their district. Their Bill enabled them to give a supply either at the boundary of the county boroughs or at such part of their areas as might be agreed upon.

Mr. Pember said he did not agree with this interpretation of the South Yorkshire Bill.

The Chairman remarked that that was a question which counsel would have to argue. They were not giving a decision one way or another, but they wanted to know what the terms of the South Yorkshire promoters to the county boroughs were.

Mr. Fitzgerald replied that if his Bill did not do as he said, then he would undertake to alter it in that way.

The Chairman said that he understood that Manchester and Liverpool were excluded under the South Lancashire Bill, and that there was no enabling clause as that proposed in the case of Sheffield, Leeds and Bradford.

Mr. Fitzgerald said that Liverpool and Manchester were struck out at their own wish, but in the case of Sheffield and the other places they were included in the Bill at their own wish.

Mr. Douglas Vickers, a managing director of Messrs Vickers, Sons and Maxim, of Sheffield, Barrow and Erith, said that of recent years at Sheffield the company had put down no machines except those driven electrically, for it was policy for them to extend on electrical lines by reason of the price. The electric lighting company which existed before the Corporation bought it had no plant for supplying, nor was their system suitable for supplying, electricity for power purposes. Had the Corporation been able to supply them at 1d. per unit, it would have been a very serious inducement to his company to have taken it from them, instead of putting down their own plant.

Witness was cross-examined at some length as to the position of

the syndicate if the Bill was passed, but denied that there was anything in the nature of a gamble connected with it. His company produced electricity at the cost of $\frac{8}{10}$ths of 1d. per unit. He was aware that the Sheffield Corporation had spent a large sum of money in getting their systems changed, and if their price was satisfactory, there was no reason why their power should not be used.

Mr. Balfour Browne, K.C., pointed out that there was a danger of the syndicate, if they got their Bill, underwriting their money, and if the members of the syndicate had subscribed £200 each towards the costs of the Bill, they might get £400 for it.

Mr. Pember said that if it could be shown him in the Bill how that was likely to occur, he would undertake to have it altered.

Several other witnesses connected with industrial concerns in the district intended to be served by the Bill were called in support of it.

Mr. Robt. Mac Shaw, the Mayor of Huddersfield, stated that the Corporation of that town were in favour of the Bill. It was a fact that the Corporation petitioned against the Bill, but the petition was withdrawn, because they had come to terms with the promoters. The South Yorkshire Bill had given them the same terms.

Mr. Mill, the secretary of the Huddersfield Chamber of Commerce, who also supported the Yorkshire Bill, was asked by the Chairman if the Chamber had any strong objection to the South Yorkshire Bill, and said they had not, although they preferred the Yorkshire Bill.

Mr. G. R. Portway, the president of the Leeds Chamber of Commerce, expressed the opinion that it would be a misfortune if Leeds were excluded from the operations of the Bill.

Several other witnesses having given similar evidence from Leeds,

Mr. J. W. Smithies, president of the Halifax Chamber of Commerce, said the Council of the Chamber of Commerce would not support either Bill, because they thought the maximum price of the power was too high, but he, personally, supported the Yorkshire Bill.

In cross-examination, Witness said he was not aware that the South Yorkshire Bill had a lower scale of charges than the Yorkshire Bill, and if it could be shown that he would be able to get power 20 per cent. cheaper by the South Yorkshire scheme, he would certainly, as a business man, support it.

Other evidence of a similar nature was called from Halifax.

Mr. W. C. Dixon, director of the Wool Combers' Association of Bradford, stated that electric power was of the greatest use in driving machinery in the wool combing and wool washing trades, and he was looking forward to the company supplying Bradford if the Corporation would let them.

In cross-examination, Witness said it would be a great temptation to the wool combers of Bradford to support the South Yorkshire Bill if that company could supply the power 20 per cent. cheaper than the Yorkshire Company. He was not aware that the Bradford Corporation was not opposing the South Yorkshire Bill.

Mr. H. S. Child, mining engineer, of Wakefield, stated that electricity was of great assistance in coal mining. Electricity was safer in mines for hauling and pumping than steam, and was cheaper than compressed air.

On Friday the Committee had a short sitting, when a lot of further local evidence in support of the Bill was called.

Amongst the witnesses called was Mr. W. H. Chambers, manager of the Deneby and Cadeby Main Colleries, who stated that they used electricity at present, but hoped to use more if the Bill was passed. It had been proved that coal existed to the east of Selby and Doncaster, and if they got a supply of electrical power in the district, the preliminary boring would be greatly expedited.

Mr. John Waugh, mechanical engineer, of Bradford, estimated that if the Bill was passed, there would be a saving of 50 per cent. in the cost of motive power in the district, and he also believed it would be a great advantage to agriculturists.

Mr. H. A. Brundell, of Doncaster, drainage engineer, thought the proposed supply of electrical energy would be of the greatest utility in drainage and sewage disposal in the district.

At the sitting of the Committee on Monday a number of local witnesses gave evidence in support of the South Yorkshire Bill.

On the proceedings being resumed after luncheon, Mr. Pember, K.C., addressing the Committee, said: During your absence at luncheon a settlement has been absolutely arrived at between the South Yorkshire Company and our company. The South Yorkshire Bill will be withdrawn. The terms of the settlement shall be presented to you and put before you at once. I am quite sure that there is nothing in the arrangement but what you would agree with. The main elements of the agreement are:—(1) That we accept three gentlemen from the South Yorkshire Company on our board, and I am quite sure that their names will be approved by you.

The Chairman: It is practically an amalgamation.

Mr. Balfour Browne, K.C. (for the South Yorkshire Company): Yes, sir, an amalgamation. The only opponent to our Bill is the Yorkshire Electric Power Company. At the same time we shall keep alive our Bill until the amalgamation is effected.

The Chairman: Bradford, Sheffield and Leeds wish to be excluded from the Yorkshire Bill?

Mr. Pember: Yes, sir. I will read to you the heads of arrangement between the two companies. "The names of Mr. Hardman Arthur Earle, Sir Richard Mottram, and Mr. William Paul Fawcus, promoters of the South Yorkshire Company, are to be added to Clause 26 (the directors' clause) of our Bill. The South Yorkshire Bill is to be withdrawn, the costs of the Bills to be paid by each side according to the number of their representatives on the directorate. The costs clause of the Yorkshire Bill to be altered so as to admit of the whole of the costs being under this Bill."

The Chairman: Sheffield, Bradford and Leeds are still opposed to the Yorkshire Bill. They are asking for total exclusion?

Mr. Pember: Yes, sir.

Mr. Wedderburn, who represented the Leeds Corporation, said that the South Yorkshire Company had an agreement with the Bradford Corporation by which they were to go through a wayleave along an ismuth to the north of the city, and he would like to know how the amalgamation was affected by that arrangement. He would like to know whether the Yorkshire Company were going to consent to the same arrangement.

Mr. Balfour Browne said that the Corporation of Bradford would give to the Yorkshire Company the same as they had given to the South Yorkshire Company and no more.

Mr. Pember, on behalf of the promoters, said he should want time to consider that point.

The Chairman asked if there was any arrangement with Leeds.

Mr. Wedderburn said there was not.

Mr. James Swinburne was then called and gave evidence as an electrical engineer. He said he was not connected with the company as a promoter. The reason the promoters wished to have a wayleave through Sheffield was that they wished to connect with the Derbyshire and Nottinghamshire Electric Company. It would be a convenience to connect the two undertakings, so as to put them in a position to help one another in case of breakdown.

In cross-examination by Mr. Gerald Fitzgerald (for the Sheffield Corporation) the Witness said six miles of the canal were in the district of Sheffield, and Sheffield was at the very edge of their district. There was no place beyond Sheffield where the company could supply, and their only reason for going through Sheffield was to couple with the company which was to supply the adjoining district.

In reply to Mr. Loder (a member of the Committee), Witness said it was competent to the promoters under the Bill to supply railways and canals in Sheffield, Bradford and Leeds from the wayleave main from within the city limits, but Mr. Pember said if there was any apprehension on this point he would put these cities in the third schedule of the Bill, and make that impossible by stipulating that the railways and canals in those cities should be supplied from the mains outside.

The Committee adjourned.

London County Council Tramways Bill.

On 8th inst., Mr. Seale Hayne's Select Committee of the House of Commons commenced the consideration of the Tramways and Street Widenings Bill of the London County Council. The chief opposition came from the railway companies, but the Metropolitan Borough Council of Holborn and a number of owners petitioned against the Bill.

Mr. Freeman, K.C., who appeared for the County Council, stated that the Bill was for authority to make new lines and the necessary street improvements. Where the consent of local authorities had not been obtained to suggested lines they had been struck out of the Bill, except in the case of the Farringdon Road tramway, which ran through the districts of Finsbury and Holborn. The first authority had consented to the line, but the latter had refused, and consequently it was asked that their consent should be dispensed with. The Bill now referred to a small line in the Archway Road, Holloway, in order that a connection might be made with the Middlesex Light Railways and the Farringdon Road line. There were also a number of proposed extensions on the south side of the river, where most of the tramway service was already being worked by the Council itself.

Sir Alex. Binnie was called in support of the Bill, and said that it was proposed to work the Archway Road line on the overhead trolley system. The cost of the tramways under the Bill would be £444,920, but the whole estimated expenditure under the Bill, including street widenings, was £1,012,000.

Witness was cross-examined by counsel for the various railway companies as to whether the proposed tramways would not cause a congestion of traffic at the entrances to Farringdon Street Station, Waterloo Station, and Blackfriars. He contended that the local authorities and the Council who approved of the proposals were the best judges of this.

At a further sitting of the Select Committee, Sir Alex. Binnie admitted, in answer to Mr. Moon, who represented the County of London Electric Railway Bill, that it would be reasonable for the Council to pay the cost of replacing any electric mains which might have to be moved in consequence of footpaths being set back.

Mr. J. W. Benn, the chairman of the Highways Committee of the London County Council, stated that the Council already owned 74 miles of tramways, and in every case exercised their right of purchase directly the term of the companies lapsed. There were still about 35 miles of tramways owned by companies in the county, but the greater proportion of these would be purchaseable before 1903, and within 10 years the Council could exercise its right with regard to the whole of them. On the north side of the Thames 49½ miles were owned by the Council, but were leased to the North Metropolitan Tramway Company. The lease would expire in 1910. On the south side the 24 miles of tramways were worked by the Council itself, with good results to the ratepayers. With respect to the proposed lines, the Archway line was necessary to join up the northern system with the authorised Middlesex system of light railways. All the suggested lines on the south had been approved of by the local authorities, and with regard to the opposition by the railway companies on the ground of the congestion of traffic near the railway stations, it simply meant the substitution of electric tramcars for omnibuses. With regard to the line from Camberwell

Green to Forest Hill, that would open up a new district now unprovided with tramways.

In cross-examination, WITNESS said that the tramway schemes of the Council largely owed their origin to the housing problem.

Other evidence was called in support of the Bill.

At further sittings of the Committee, other evidence was called in favour of the Bill. Mr. MITCHELL, a member of the Metropolitan Borough Council of Camberwell, gave evidence as to the need of tramways in Dulwich, where at present they had no service.

Mr. A. T. MOORE, a member of the same Council, expressed the opinion that the extension of tramways to Dulwich would not depreciate the property in any way.

Mr. TAGG, clerk to the Metropolitan Borough of Camberwell, stated that his Council had passed a resolution giving consent to the tramways proposed by the London County Council.

Other witnesses, residents in the districts proposed to be served by the tramways, gave evidence to a similar effect.

Mr. LAWRANCE strongly opposed the Dulwich part of the scheme on behalf of the governors of the Dulwich College; he stated that the revenues of the College would be seriously affected by the tramway which would depreciate the residential property in the district.

Evidence was called to bear out counsel's statement.

Mr. MUNROE, who represented various frontagers in Camberwell, also addressed the Committee in opposition to the scheme, and called a number of local witnesses in support of his case.

Mr. ROSKILL opposed the Bill on behalf of the frontagers along both the Peckham Rye and the Archway Road route, and Mr. RICKARDS, K.C., opposed, on behalf of the South-Western Railway, the line from Westminster Bridge Road to Stamford Street, on the ground that it would greatly tend to congest the already crowded traffic in the vicinity of the company's stations.

At further meetings of the Select Committee a considerable amount of evidence was called on behalf of the London and South-Western Railway Company in opposition to the proposed new line along York Road and Stamford Street and the extension of the existing Waterloo Road line towards Waterloo Station.

Amongst the witnesses called was Mr. C. J. OWENS, the general manager of the London and South-Western Railway Company, who said he considered to take a tramway along from Westminster Bridge to the Borough High Street as ill-conceived and ill-designed, for all that could be done by the proposed tram could equally well be done by the existing tramway from Lambeth Palace to the bridges.

Mr. POLLOCK, K.C., who represented the frontagers of York Road and Waterloo Road, submitted to the Committee that this was a case in which the balance of public opinion was against the tramway.

Mr. CLODE addressed the Committee for the railway companies on the question of the present congested state of the roads near the stations affected, and contended that if the tramways were authorised it would lead to constant accidents.

Mr. BAGGALLAY, K.C., on behalf of the Metropolitan Borough Council of Holborn, urged the Committee not to authorise the Farringdon Road extension, for all that the line could do was to bring people 300 yards nearer the Markets, and the road was already very crowded.

Evidence was called on behalf of the Borough Council of Holborn bearing out counsel's statement.

On Monday evidence was called on behalf of the Great Northern Railway Company to show the unsuitability of Farringdon Road for tramcars, and Mr. POPE, K.C., addressing the Committee for the railway companies, contended that the balance of public opinion was against the construction of such a tramway.

After further evidence had been heard in opposition.

Mr. FREEMAN, K.C., replied on the whole case for the L.C.C., and submitted that the proposals of the Council were necessary for the proper joining up of the tramway system of London.

After consulting together in private the Committee decided that the preamble of the Bill was proved, with the exception of the parts relating to the Farringdon Road extension and the piece of tramline in York Road, Lambeth.

London Underground Electric Railways.

THE Joint Committee considering the various underground electric railway Bills submitted to them sat again on Friday last.

At the commencement of the proceedings, Mr. LITTLER, K.C., said he understood that Lord Rayleigh's Committee on Vibration held a meeting the previous day, and came to some resolution on the matter of vibration which had been communicated to the Board of Trade. What the resolution was he did not know, but he asked, in view of the importance of the matter, that the Joint Committee should ask the Board of Trade to communicate with the Committee, as it might help to bring the minds of the Committee to some conclusion on what was a very momentous question for the promoters.

CITY AND NORTH-EAST SUBURBAN RAILWAY.—Mr. WARNER, M.P., who, as the owner of considerable property in Walthamstow, spoke in favour of the Bill, was cross-examined by Mr. Littler with regard to the opposition of the North London Railway. WITNESS considered that if the contention was to hold that the proposed railway would cause the North London Railway Company to run less trains, it would apply to every electric railway proposed. He never suggested that the Great Eastern Company had not done all they could to meet the pressure, but he did say that the trains of that company were still crowded, and nothing which the Great Eastern Railway Company could do would relieve the pressure.

In answer to Mr. Moon (for the North-East London electric line), WITNESS said he would support any railway which went direct from Walthamstow to London. He recognised that the proposed North-East London Railway would give access to Stamford Hill and Hoxton, and so on to Liverpool Street, from whence they could get to the West by the Piccadilly and City Railway, which it would join. He had no objection to that railway, but he considered the City and North-East Suburban Railway the best.

Mr. D. J. MORGAN, M.P. for Walthamstow, stated that Walthamstow required additional railway accommodation towards the city at certain times of the day.

By Mr. LANCASTER (for the Great Eastern Railway Company): He had heard of the proposals of the Great Eastern Railway Company to construct tube railways under their present lines. If this were done, of course the Great Eastern Railway could utilise the underground lines for express trains.

Lord KNUTSFORD said he presumed evidence would be called to show that it was the intention of the Great Eastern Railway to construct such electric railways.

Mr. LANCASTER said this would be done.

Mr. WRAGG, vestry clerk for Leyton, said the people of Walthamstow and Leyton would like both the proposed tube railways, but they would prefer the City and North-East Suburban of the two.

Mr. E. GOOD, vice-chairman of the Walthamstow District Council, supported the Bill.

Other evidence of a similar character was called in support of the Bill.

NORTH-EAST LONDON RAILWAY.—Mr. BALFOUR BROWNE, K.C., briefly opened the case for the proposed North-East London Tube Line, which was intended to start from Bishopsgate Street up north to Tottenham, with a branch to Chingford. He compared the line with the one which the Committee had just been discussing, and said it was well backed up, and the capital could be found. The Piccadilly and City Railway, with which line they proposed to form a junction, was promoted by the same set of financiers as the Bill he now alluded to. By the proposed junction, through communication would be obtained to the west of London, while by the communication between the Mansion House and Tottenham, a densely populated area would be served, and the line would become almost a necessary condition of the proposed workmen's settlement of the London County Council at Tottenham. If the Committee came to the conclusion that there was enough traffic for both this railway and the one which they had just been considering he had not the slightest objection, he was perfectly prepared to enter into competition with other lines.

Sir DOUGLAS FOX, the engineer to the scheme, gave evidence in support of the Bill. He said the proposed line would commence at the Cannon Street station, underneath the District Railway, and would proceed along Gracechurch Street, and from thence straight alone the Kingsland Road to Tottenham. At the Monument they would connect by means of a subway with the Piccadilly and City Railway. They could also have subways to connect with the City and South London Railway and the Great Eastern Railway at Liverpool Street. Also it would be possible to form a junction with the proposed deep level District Railway, if that line was ever constructed, as to which he had his doubts. Theirs was a direct through route, and would not be subject to the intervention of any junction. They proposed to have a branch line to Chingford, which would go by way of Clapton. They would give a 2½-minute service on their main line. The Chingford branch would serve Leyton, which was a very important working-class district.

The Committee adjourned.

AT the sitting of the Committee on Tuesday, the CHAIRMAN, Lord Windsor, before proceeding to take evidence, made a touching reference to the late Sir Courtenay Boyle. He said that on his own behalf, and on behalf of the Committee, he wished to express his very deep regret at the sudden death of Sir Courtenay Boyle. He was sure that feeling would be shared by everyone accustomed to come into those committees' rooms, as it would be certainly by everyone in the room, who had any knowledge of Sir Courtenay Boyle's public services. They had hoped to have had the benefit of further assistance from him, and further advice from him on many particulars connected with the present inquiry. It was not for him to say more than to express their extreme regret at his sudden and premature death.

Mr. LITTLER, K.C., on behalf of the Parliamentary Bar, said he could only re-echo the words of the chairman with regard to the death of Sir Courtenay Boyle. As the representative of one of the schemes now being promoted before the Committee, he had hoped to have had the assistance of his advice and ripe experience. His knowledge of Sir Courtenay Boyle extended over many years, and included acquaintance with the good work he did before the Railway Rates and Charges Committee. He was quite sure that no more courteous, no more able, no more accomplished gentleman ever served the Government. They had deep sympathy with those near and dear to him, and heartily concurred in the regret their Lordships had expressed.

The CHAIRMAN announced that the Committee had received a communication from the Board of Trade with regard to the Charing Cross, Euston and Hampstead line, and after very carefully considering it, they saw no reason for altering their previous decision.

Mr. C. F. JENKIN, assistant works manager to Siemens Bros., then described the contemplated electrical arrangements for the North-

East London Railway. He said it was proposed that the return current used by the line should be connected by an insulated return. If a simultaneous breakdown occurred on the positive and negative lines, the trains would not run until connection was re-established. The current would be switched off by automatic cut-outs, at once disconnecting the source of power from the circuits. Such breakdowns might happen, but they were more likely to occur on tramways or lighting systems than on a tube system insulated as he described it. The method of working proposed was by multiple motors distributed along the train at more or less regular intervals. Using this system, there would be no necessity for a loop line; all that would be required would be a shunting neck at the terminus, and ample time would be allowed for a 2½-minutes' service. The scheme was not a final one, and before the line was constructed every advantage would be taken of improvement. He assumed that the pressure would be 500 or 600 volts.

Major CARDEW, late electrical adviser to the Board of Trade, gave evidence to the same effect.

Mr. J. F. S. GOODAY, general manager of the Great Eastern Railway, was examined in opposition to the proposed lines. He said that while the Great Eastern were not prepared to go to Parliament immediately with proposals to increase accommodation for their suburban traffic, his directors had considered certain proposals, and in their name he asked the Committee not to give sanction to any scheme which would interfere with the user by the company of the ground under their line. In the face of the probable report of the Vibration Committee, in view of the fact that the Central London system had now been found to have been worked on wrong lines, and in face of further developments in electrical engineering, the directors felt they were not prepared to recommend their shareholders to find the money for an extension scheme at present. The view of the directors of his company was that the company which had created these suburban districts should be allowed to provide the further railway accommodation necessary.

Mr. WILSON, engineer to the Great Eastern Railway Company, stated that he had consulted Sir B. Baker as to the best means of increasing the accommodation for their suburban traffic. As a result he recommended a tube railway at a depth of about 54 ft. below the level of their present line. The proposed North-East London and City and North-East Suburban lines would cross the route he had contemplated at about the same level. It was, however, quite possible that the engineering difficulties could be adjusted.

Mr. NEAL, electrical engineer to the North Staffordshire Railway, gave evidence of the serious effect of stray earth currents on delicate electrical apparatus, and said that, in his opinion, the system proposed on the North-East London line would not prevent leakage.

Mr. MOON then briefly opened the case for the Islington and Euston Railway. He explained that the proposed line, which would be 1½ miles in length, would run from an end or junction with the Islington extension of the City and South London Railway to an exchange station with the Charing Cross and Hampstead line at Euston Road. The line was practically an extension of the City and South London line, although it was being promoted by separate capital.

The Committee adjourned.

ELECTRIC LIGHTING IN MARYLEBONE.

THE Electric Light Provisional Order (No. 1) came before a Select Committee of the House of Commons, presided over by Mr. Caine, on Tuesday. The memorandum attached to the Bill stated: "In 1889 the Metropolitan Electric Supply Company, Limited, obtained an order giving them electric lighting powers in the parish (now the borough) of St. Marylebone. In 1898 the Vestry (now the Borough Council) applied for an order authorising them to supply electricity in the borough in competition with the Metropolitan Company. This order was granted by the Board of Trade, but its confirmation was opposed by the Metropolitan Company, and refused by Parliament, after hearing by a Select Committee. In 1900, after various representations had been made to the Board of Trade of the necessity for a competitive supply in Marylebone, the Board granted an order to the Marylebone Electric Supply Company, Limited. The confirmation of this order was opposed, and refused by Parliament on the second reading of the Bill. This session the Borough Council and the Marylebone Company have both applied for orders. The Board of Trade have granted both orders, with the view of giving Parliament the opportunity of deciding on the question as a whole." The two orders referred to were before the Select Committee. An agreement was arrived at, under which the order of the Metropolitan Council of Marylebone was passed, and the Bill became an unopposed measure.

CLYDE VALLEY ELECTRIC POWER BILL.

ON Thursday and Friday of last week the Select Committee of the House of Commons sat to settle the clauses of the above Bill.

Mr. WILSON, K.C., who represented the promoters, said he had framed a clause, as suggested by the Committee, which would give the company the right to put their mains through Port Glasgow and Hamilton, but not through Govan and Partick.

Considerable argument took place as to whether Paisley should be omitted from the Bill, so far as the company having compulsory powers to lay mains through the streets was concerned. On behalf of the company it was stated that unless they were given these powers it would involve a large extra expense, and that the mains could easily be taken through side streets without causing any inconvenience to the public.

Mr. ERSKINE POLLOCK, on behalf of Paisley, said he understood the Committee had struck them out of the Bill last week, and he thought that point was settled.

The CHAIRMAN said that the Committee had decided the point somewhat under a misapprehension on facts which were now more clearly apparent. He suggested that it would be well for the parties to come to some arrangement in view of the altered condition of affairs.

MR. POLLOCK said he must adhere to his first position, viz., that it was not necessary for the company to go through Paisley at all.

The CHAIRMAN: Well, I may tell you the Committee have made up their mind that they shall go through Paisley.

Mr. POLLOCK replied that in that event it was useless arguing the matter any further there, and he would reserve his opposition for the House of Lords.

Considerable discussion next took place with reference to possible competition on the part of the company with the electric lighting undertakings of local authorities. The Committee had intimated a desire that words should be inserted in the Bill to secure the subordination of lighting to power in the case of the company's supply, and Mr. Wilson proposed a clause which in effect provided that the quantity of power used for lighting should not exceed 20 per cent. of the total amount of power supplied in any single case.

This was agreed to, and the other clauses of the Bill were adjusted.

ELECTRICAL ENGINEERS R.E. (VOLUNTEERS).

REGIMENTAL ORDERS.

1. Non-commissioned Officers' Instruction Class.—Wednesdays, 6.30 p.m.
2. Recruit Drills.—Tuesdays, 6.30; Thursdays, 7.30 p.m.
3. Oil Engine Instruction.—July 4th to 13th and July 11th to 20th Camps, Mondays, 6.30 p.m.; June 6th to 15th and June 13th to 22nd, Tuesdays and Thursdays, 6.30 p.m.; July 18th to 27th and August 8th to 17th, Wednesdays, 6.30 p.m.; August 15th to 24th, Fridays, 6.30 p.m.; Royal College of Science and School of Mines Party, on Tuesday, 4.30; Central Technical College Party, on Tuesday, 5.30.
4. Uniforms issued on Tuesday and Thursday, at 7.30 p.m.
5. Equipment issued on Tuesday and Thursday, at 6.30 p.m.
6. Trainings, 1901.—It is requested that all N.C.O's. and men who can change the date of their training to the weeks commencing July 13th to 20th, or July 20th to 27th, or who can stay both weeks, should notify the Actg.-Sergt.-Major at once.
7. Formal Opening of Headquarters.—Saturday, June 1st, 4 p.m.; tickets for admission, including tea, members of Corps 1s. each. There are a limited number for friends at 5s. each. Applications to be made to the Actg.-Sergt.-Major.
8. Cycling Club.—General meeting at Headquarters on Tuesday, May 28th, 8.30 p.m.
9. Woolwich Detachment.—Drills, Recruit and Company, every Friday, 8 p.m.

(Signed) R. S. ERSKINE, Major,
O.C.E.E.R.E.V.

Headquarters, Regency Street,
Westminster, S.W.

CORRESPONDENCE.

The British Press and British Industry.

Referring to the article under the above heading in your issue of the 10th inst., I regret that a paper of your standing should criticise the British Press for their "unfair attitude towards an important home industry." I maintain that this attitude, generally speaking, is not unfair. The Press, in comparing our own productions with those of the Continent and America, endeavour to lift us from our lethargy, and point out to British manufacturers what our competitors are doing. In this way they prepare us for the ever increasing competition.

One thing is very evident—the Press cannot be accused of having erred if they have studiously pointed out that the Americans are far superior to us in all matters relating to the electrical industry, and that on this score British manufacturers have lived in apathy rather than striven with energy to obtain their share in the electrical world. It is instructive to note the change that has taken place in the Press during the last 10 years. They now take a keener interest in all matters relating to national industries; and this must be of great service to British manufacturers in general. The Press, it is specially notable, now deal with

modern progress and industries from a very broad point of view, and write on all progress on its merits and not from an ultra-foreign or ultra-patriotic point of view. In short, they take the world as a field of resource for their matter and pick out the best therefrom, which practice is followed by most of our leading firms who want the best and cheapest means of production in order to keep British-made goods in the markets of the world on their merits and sound construction, and not because they are purely British. For old times have changed, old manners have gone, and competition holds sway. To see the truth of this remark one has only to read the advertisements in our engineering journals, where he will find most of the leading firms of America and the Continent advertising their special class of machinery. We can rest assured this is not done from a patriotic point of view, but from a keen business view and a likelihood of obtaining orders in the very heart of the engineering world.

T. W. Sheffield.

Manchester, *May 14th*, 1901.

Where to Construct New Electric Works.

I would refer your correspondent, R. W. Lynn, to my short note in your issue of August 18th, 1899, in which you may remember I advocated Ipswich as a good centre for establishing new works.

After 20 years spent in Leeds, one in Gateshead, two in Loughborough, three in Wolverhampton and five in London, all the time closely in touch with engineering work, I am still of opinion that Ipswich offers exceptional facilities. It has long been a successful engineering centre, is within easy reach of London and the Continent, and is practically a seaport, whilst the conditions of living—cheap house rent and food, easy access to pretty country, &c.—are very favourable to the artisan.

E. Kilburn Scott.

Electric Blowing at Lincoln Cathedral.

The letter which appeared in your issue of the 10th inst., signed by Mr. Hutton and Mr. Mantle, most certainly would give readers the impression that our organ blowing installation at the cathedral was a failure, and that such failure was the fault of my firm's work, and in pure fairness I must ask you to grant me space in your valuable medium to insert this letter in order to clear away such a wrong impression.

When the use of electricity was first proposed for this large organ the late Mr. Willis scorned the use of such power, believing that only "a toy organ," as he expressed it, could be blown electrically, and it was only after I took him with Canon Hutton (your correspondent's father) to St. Margaret's, Westminster, the Royal College of Music, and other of my firm's installations that he (Mr. Willis) was willing to believe that electricity was a power worth mentioning. After the above-mentioned visits, though to a considerable extent convinced, nevertheless Mr. Willis's doubts were such as led to our being requested to sign a lengthy agreement in which was set forth all technical detail, &c. This was signed, fulfilled, and the work paid for earlier than was called for in the agreement, and this speaks for itself. The speeds of crankshafts asked for were 30 revolutions for each wind or set of bellows.

It was seen with time that Mr. Willis had been over-nervous, and tests made showed that we had been asked to give too much power, as full organ only called for speeds of 5 revolutions and 7 revolutions on two winds instead of 30 each. The determination of the number of revolutions, of course, is always in the hands of the organ builders alone.

After much correspondence and consideration of the subject, Messrs. Willis proposed to do away with one motor altogether, and let one motor supply two sets of feeders. Our advice was asked for throughout by Mr. Hutton, and willingly given, and on January 25th, 1901, Mr. Hutton writes in reference to our estimate for the alterations, saying the Dean and Chapter have considered our estimate, and he adds: "They consider that, as it is chiefly mechanical engineering that has to be done, and there are several firms here capable of doing the work, it could naturally be done more cheaply here than by anyone who has to bring men and material from a distance. Therefore, they have decided not to accept your estimate." So the only reason this work was not entrusted to us was because it was a minor alteration any mechanic could do. The quotation he mentions in his letter to your paper is from our letter of January 26th, 1901, replying to the above, when we write that we, of course, cannot be responsible for work done by another firm. Mr. Hutton's quotation, therefore, when read with the context, bears a very different construction from that suggested by his letter.

Arthur Bergtheil, M.I.E.E.

London, E.C.,
May 15th, 1901.

Train Wrecking in War-time—A Suggestion.

In view of the enormous losses sustained in South Africa due to the train-wrecking tactics of the Boer commandoes now in the field, would it not be advisable to devise some scheme whereby a pilot truck is run ahead of each train by means of electric power generated in the main train, and conducted to the pilot car by means of a light steel armoured cable? The tension on the cable would be approximately the same for all speeds, depending on the voltage generated by the main dynamos, though probably it would be necessary to automatically cut in an extra winding on the field magnets for the higher speeds due to the deterrent effect of wind pressure, &c., at those speeds. The voltage would be high, in order to allow of a light cable being employed. If necessary, a storage battery could be employed to provide power to start the pilot car from rest, and prevent over-running the cable while the dynamo is picking up at starting. The return would be through the rails. The car would be sufficiently light to allow of derailing and attaching to rear of train if required to run in opposite direction.

Hugo Gibson.

Birmingham, *May 21st*, 1901.

Resistance Material.

We are much interested in the letter on "Resistance Material" by "Non-Magnetic," and if he can tell us in which country he can buy non-magnetic resistance material with a comparatively high resistance in the form of strip at 2d. per lb., we should feel obliged for the information. We manufacture resistance material in the form of wire, strip, wire netting, wire strand, &c., from material which has a resistance of 8 up to 51 times that of copper, but so far have not been able to produce a reliable resistance material at 2d. per lb. Some years ago we used to draw manganese steel for this purpose, but there was such difficulty in manipulating this stock that we gave it up, but we never heard of this material being sold at 2d. per lb. We export raw material for making resistance wire into the States, paying a high duty, and even after paying this duty the Americans are able to manufacture resistances and import the resistance frames, &c., complete into this country, which seems to point to the manufacture of resistances being at fault rather than the manufacture of the resistance material. We shall be pleased to give your reader any further information regarding our "Beacon" or other high resistance materials.

W. N. Brunton & Son.

Musselburgh, *May 20th*, 1901.

The Meeting of the American Institute.

I have received—no doubt in common with other members of the Institution—a communication from the secretary of the American Institute of Electrical Engineers very kindly conveying an invitation to visit them at Buffalo on the occasion of their summer meeting.

It appears that the Council has not finally decided upon the date, but that it awaits the replies and suggestions from Europe as to the number of visitors they may expect, and the general convenience of the greatest number.

It would be well, in response to such a genial and courteous

invitation, that the American Council should not be delayed in their arrangements a day more than necessary, and I therefore beg to suggest—if you will permit me to do so—that all who think of proceeding to the States should at once communicate with the secretary of our own Institution, who might arrange with some gentleman who should act as secretary and organiser to the party.

The very cordial manner in which the American Council has sought to meet the convenience of its visitors demands every possible attention on this side.

T. Scott Anderson.

Sheffield, *May 18th*, 1901.

Accumulator Design.

If Mr. D. Tommasi will refer to the patent of the Monobloc Accumulator, he will find that the claim is quite different to his own, the invention relating to the horizontal superposition of thin sheets of lead to form the block, from which this accumulator takes its name.

The use of negative electrodes in the form of a pencil is, we are informed, old. Further, the separator does not perform the functions mentioned by Mr. Tommasi.

Monobloc Accumulator Syndicate, Limited.

Westminster, *May 17th*, 1901.

BUSINESS NOTES.

Bankruptcy Proceedings.—The statement of affairs in the case of George Frederick Cook, of Charles Street, Bradford, electrical engineer, shows liabilities to the amount of £516 10s. 8d., and assets estimated at £188 12s. The debtor began business in 1899 with £200 capital, and covered expenses during the first 12 months but not since. He states that he has lost £450 on a contract for the electric lighting of the Bradford Workhouse, and £50 on one for the Skipton District Council, and he filed his petition when proceedings were being taken by a creditor to garnishee a debt of £125 owing to him. The trade creditors over £10 are as follows:—Edison & Swan, £47; W. T. Henley's, £110; Markt Bros. & Co., £121; Morley Electrical Engineering Company, £28; New Brotherton Tube Company, Limited, £20; W. Rickard (Derby), £10; and M. J. Sewell (Brighouse), £37. The public examination was fixed for Wednesday, the 22nd.

Dissolutions and Liquidations.—The Electric Incandescent Lamp Regenerating Syndicate is winding up voluntarily, with Mr. A. Banister as liquidator.

A meeting of J. G. Statter & Co. will be held on June 21st, to hear an account of the liquidation proceedings from the liquidator, Mr. F. J. Tingle.

A meeting of the Tramways Union Company, Limited, will be held on June 20th for a similar purpose.

A meeting of the United Telephone Company will be held at 5, Moorgate Street, E.C., on June 26th to receive the liquidator's report.

Messrs. C. Lang and M. Plato (Chas. Lang & Co., manufacturers and dealers in electrical goods, of Minories, E.C., and Berlin) have dissolved partnership.

Books Received.—"Directory of the British Anglo-Argentine and North American Residents in the Argentine Republic and Argentine Commercial Guide." Fourth edition, 1901. Edited by E. Danvers. Buenos Ayres: John Grant & Son. 5s

"The Law of Universal Balance," by A. Shetlander. Lerwick: T. & J. Manson. 1901.

"Moteurs Synchrones à Courants Alternatifs," by A. Blondel. Paris: Gauthier-Villars. Paper, 2fr. 50c.; cloth, 3fr.

The Continental Arc Lamp.—One would hardly expect to find an impedance coil in a direct current arc lamp; yet this is the principal feature of the "Continental" lamp, which is being introduced into this country by the Stewart Electrical Syndicate, Limited, of 57, New Compton Street, W.C. This lamp is of the enclosed type, and is suitable for supply pressures of 100 to 115 volts. The feed is controlled by a clutch, acting direct on the positive carbon, and coupled to the iron cores of two compound solenoids. Each of the latter consists of a series and a shunt coil. The latter is connected with the terminals of an impedance coil of the "Hedge-hog" type, of very low resistance, but of high inductance. When the current is steady, practically the whole of it goes through the impedance coil, leaving the series solenoids free to act alone: but the moment the current *commences* to vary, from any cause, the peculiar properties of the impedance coil come into play, resisting the change, and throwing the variation into the shunt coil, which exerts a force tending to counteract the variation by shortening or lengthening the arc.

Such variations are usually provided against by the insertion of a large resistance in series with the arc; but, thanks to the device described above, this source of loss is avoided in the "Continental" lamp, with the result that a higher efficiency at once becomes possible.

The following observations made in our presence will afford some indication of the improvement effected:—Current, 4·5 amperes; pressure over all, 106 volts; pressure between carbons, 90 volts; pressure across impedance coil, 14·5 volts. The remaining 1·5 volts drop is due to the series coil, &c. From these readings it will be seen that no less than 85 per cent. of the power supplied is developed at the arc itself, as compared with 75 per cent. in the usual case. The arc under these conditions is about half an inch long, giving a very free path for the light rays; but unfortunately we were unable to make any photometric tests. We have before us, however, a report of tests made at a well-known American Institute of Technology upon this lamp, which not only corroborate the observations given above, but show a gain of 35 per cent. in the mean spherical candle-power per watt supplied to the lamp, due to the use of the impedance coil.

The latter may be enclosed in a metal case, forming part of the suspension of the lamp, or may be fixed in any convenient position in the vicinity.

The globe of this lamp is noteworthy in that it is closed at the lower end, thus saving a gas-tight joint, and can be removed or replaced with the greatest facility, while the tightness of the upper joint is demonstrated by the long period during which the lambent CO flame plays about the red-hot carbons after the current is stopped. Altogether, we have formed a very favourable opinion of the lamp.

An Electrical Exhibition at West Ham.—An electrical exhibition was opened at West Ham last Monday, and it will close to-morrow (Saturday). It is promoted by the Borough Council, and its sole object is to educate consumers in regard to the applications of electricity for lighting and power work. It fulfils this purpose admirably, for a score of exhibitors directly interested in the progress of electricity supply business have done their part of the work well, and have succeeded in producing a very attractive show. It is the duty—too often sadly neglected—of municipalities who have embarked upon electricity supply to push their commodity for all it and they are worth, and of all the means at their disposal to aid in achieving a satisfactory result we can think of none which will help them better than an effective system of street electric lighting, and a well arranged and attractive exhibition. The outdoor arc lighting at West Ham is, according to the Chairman of Committee, "the only thing about which there should be much bone of contention, and I hope that will soon disappear." We were for a moment just a little concerned to know whether the arc lighting or its present alleged unsatisfactory features will pass away. Presumably only the defects were meant. Whatever is to be said for or against the street lighting of West Ham, the private lighting custom has gone ahead so well that to-day (pending the completion of the new station at Canning Town) it is not possible to take on additional consumers on any large scale; the main object of the exhibition is to create a day load for the driving of motors, a class of work for which there seems to be considerable scope in the Council's area.

Before turning to take a glance at the exhibits, we ought, perhaps, to refer to the opening function. For able speeches, flights of rhetoric, dignity of bearing, and all those other admirable qualities which go to make up the unimpeachable character of the local dignitary, the councillors of the Borough of West Ham would be hard to beat. We leave it to the sprinkling of electrical men who were there to say whether we are not right. The chairman of the Lighting and Tramways Committee, Alderman Ivey, having stated statistically the progress of the lighting undertaking, explained that their guests had been invited to attend the function that afternoon purely in order that they might do business with them and bring grist to the mill. He said that the West Ham undertaking had been the subject of much discussion in the Press and in the Council chamber, and we remembered things said in the ELECTRICAL REVIEW in days gone by. He told us that "electric light current is different altogether to the manufacture of gas," and paid Mr. Bock, the resident electrical engineer, the compliment of being "not only pushing, electric, but also hopeful" about the financial result for the current year. Only the big consumer gets discounts at present, but Alderman Ivey would like to see the discount system allowed to small consumers as well. They had "some 6,000 H.P. lying at the central station," and the eight large boilers at the electricity works, so he told us, "are all used for generating current." He referred to the Public Health Act, and its provisions as to drainage, and added that he firmly believed, that, in some years' time, everyone will be compelled by Act of Parliament to use electric light, and no one would be allowed to make any smoke. No notices had been put up requesting visitors not to touch the exhibits, but if they did so they would be sure to get a shock to satisfy their curiosity!! It was whispered on the platform that the speaker was dilating upon electricity from an Alderman's point of view. He then called upon the Veteran Mayor to declare the exhibition open.

The Mayor's speech we refrain from publishing. We could not if we would, and we would not if we could. But it was a treat such as we are not often privileged to hear, and it was undoubtedly the most entertaining part of the proceedings. A switching on of lights in all directions was accompanied by a bugle blast, and sundry speeches followed voting thanks to everybody. The final vote was "The Exhibitors," and it was responded to by Mr. Mayor Kershaw, of Shoreditch, who is very active in pushing his exhibit at the Renewable Lamp Company's stand. We were glad it was the last speech, for Mr. Kershaw could not resist the temptation to commit an atrocious pun on the name of Alderman Kidd, who was present. When he heard reports about West Ham electricity

scheme, in future he should think there was a good deal of "Kidd" about it. At this, West Ham held its sides and laughed, and the Mayor of Shoreditch looked pleased. One impression we formed on hearing the speeches, namely, that the full dress debates of West 'Am must have a good deal in common with those of 'Ackney.

The manufacture of Robertson's incandescent lamps is shown, together with a vast number of electrical fittings, motors, fans, and the "Apollo" heater, &c., by the General Electric Company, Limited, whose exhibits we mentioned last week. Mackey's incandescent lamps are exhibited by the makers; there is a showing of secondary batteries for all purposes by the Hart Accumulator Company; the B.T.H. Company exhibit their meters, motors, fans and controllers. Brockie-Pell arc lamps are in evidence, and a Ferranti latest pattern rectifier, which is doing service on the local street lighting, is caged off like a lion at a menagerie. Messrs. Young & Marten, Limited, had on view a large assortment of artistic lighting fittings, fans, standards, Jandus arc lamps, which are employed both outside and inside the building; also the Dowsing radiant electric heaters, which are to be found at several other stands as well. Messrs. Young & Marten have a further exhibit, at which electric heating and cooking are in process. Messrs. Geipel & Lange show Brown-Boveri motors, switches, and steam traps; Messrs. Jackson Bros., fuseboards, fittings, electric bells, &c.; Messrs. Hands have a good variety of electric lighting fittings; and the Babcock & Wilcox Company have on view a model of their boiler. Messrs. Veritys have a central stand, at which a very good idea may be obtained of the uses of electricity for driving and lighting, perhaps the most attractive being a Linotype run by an electric motor. The Renewable Lamp Company has a striking exhibit also in a prominent position. Messrs. Witting Bros. have on exhibition many motors (Heyland), controllers, &c., for electric driving and electric tramway work. Art metal fittings are shown by Mr. J. B. Tompkins; the "Umpire" storage batteries for X ray, testing, and other purposes, by Messrs. Marcuson & Sutherland; the Langdon-Davies electric motors, by the Langdon-Davies Electric Motor Company; some dynamos and motors by the Thames Ironworks and Shipbuilding Works; also cables by Messrs. Johnson & Phillips. The Vulcan Electric Company show a number of exhibits in operation, a single-phase alternating motor taking supply from West Ham mains being employed to drive a Canning continuous current dynamo for generating current to work machines. Here the West 'Ammer will be able to see motor-driven fans, sewing machines, drills, and metal polishing spindles.

These few brief notes will show that the exhibits are quite adequate to bring before the consuming public the uses and benefits of electricity for electric driving. Several of the exhibitors showed electric tramway machinery, the reason of this being that very shortly the West Ham Lighting and Tramways Committee will be in the market for tramway equipment.

For Sale.—Messrs. Wheatley Kirk, Price & Co. are shortly to sell by auction surplus machine tools, electrical plant, &c., at the Broadheath Engineering Works of the Edison & Swan Company, on account of removal to Ponder's End. See our business pages this week for further details. Another notice gives details of a large quantity of machine tools which the same firm will sell by auction at Leeds on June 12th and 13th.

Foreign Electrical Imports.—The value of the foreign electrical plant and apparatus imported into this country during April last, is returned at £86,629, as compared with £130,076 in the preceding month, and £58,714 in April last year. So far this year there has been a very large increase in such imports, the value for the four months ending with April last being returned at £408,318, as contrasted with only £255,732 in the corresponding four months of 1900.

Glasgow Exhibition.—We are asked to say that the numbers of the stands in the Machinery Hall are not the same as the allotment numbers. The "Buffoline" Gear Company's wheels are at work on Stands Nos. 413, 444 and 451, and not on stands announced in our issue of May 17th.

Japan.—The Japanese Customs authorities have recently given a decision to the effect that copper wire, insulated, for electrical apparatus is to be dutiable at the rate of 5 per cent. ad valorem, and not at 20 per cent. ad valorem, as a manufacture of metal not otherwise provided for.

Mr. Arthur Hyde Lay, in his official report on the trade of Japan for 1900, says that the large quantity of telegraph wire imported during that period "is an indication of the activity of the Communications Department."

Renewable Lamps.—On Monday evening the members of the Institution of Junior Engineers paid a visit to the works of the Renewable Electric Lamp Company, at Brunswick Place, City Road, London. They were received by the managing director, Mr. H. E. Kershaw, Mayor of Shoreditch. The processes carried on were shown in operation.

Schmidt Superheaters.—Messrs. Schmidt's Superheating Company, Limited, of Broad Sanctuary Chambers, have received an advice from their German office stating that after an exhaustive investigation the Prussian State Railway Administration has definitely ordered 19 locomotives, four being express locomotives and 15 being goods locomotives, to work with highly superheated steam on the Schmidt system. The sole license, in respect of stationary engines throughout Great Britain and the British Colonies, has been taken over by Messrs. Easton & Co., Limited, of Broad Sanctuary Chambers, S.W., who state that since the date of the license, the middle of January last, they have taken orders for delivery in the United Kingdom to the extent of over 16,000 H.P. They have just issued a catalogue in which the Schmidt system is very fully described, together with details of tests, and a circular which accompanies it gives particulars of the remarkable progress which has been made on the Continent. The catalogue is very fully and well illustrated with both half-tone and diagrammatic pictures.

Traction Cell.—A new cell which has been devised by Mr. J. T. Niblett, and will shortly be placed on the market, deviates somewhat from the ordinary lines. The metallic conductor used is of small dimensions and light weight; it forms the backbone of a frame wherein the active material is contained, and is so arranged that all those parts immersed in the electrolyte, and not covered by the active material, are insulated. By this arrangement, all the lead salts are brought under direct electrolytic action, and greater efficiency is obtained. The material employed in both positive and negative plates is not the usual lead oxides, but is a compound of lead salts of a conductive nature. When set and properly seasoned, the material is of a stone-like hardness, while the necessary porosity is obtained. Cells made by the new process can be formed very rapidly, and the amount of energy consumed in the formation is said to be only about half that required by the ordinary pasted type of cell. The expansion of the positive and contraction of the negative plates during formation is greatly reduced, and the elements do not tend to buckle, or shed their active material, either during the formation, or in subsequent use. It has been found that from 2·2 to 2·3 volts per cell is enough to effectually recharge. So far, plates varying from 0·1 to 0·75 in. thick have been tested, and give uniform and equally good results. The following particulars of a cell constructed for motor-car work are given:—

Number of positive plates	4
Number of negative plates	5
Gross weight of conductors in plates	3 lbs. 10 ozs.
Gross weight of positive active material	8 lbs.
Gross weight of negative active material	6 lbs. 7 ozs.
Gross weight of complete cell, including containing vessel and electrolyte	24 lbs. 9 ozs.
Normal discharge rate	16 amperes.
Current density on positive surface at normal discharge	1 ampere for 7 sq. in.
Capacity	160 ampere-hours.
Capacity per pound of complete cell	6·75 ampere-hours.

The above results were obtained with a fall of potential down to 1·75 volts per cell, but under ordinary conditions the E.M.F. may be safely run down to 1·7 volts without injury to the elements. At half rates of discharge the capacity per pound of cell was found to be 7·5 ampere-hours. It should be mentioned that the above cell was constructed for normal rates of charge and discharge. In the case of the thinnest elements yet tried, we are informed that rates of discharge of 1 ampere per square inch of positive surface have been obtained, the E.M.F. remaining practically constant. By working at this current density, cells can be constructed which can be fully discharged or charged in less than one hour, without great loss of capacity or efficiency.

Trade Announcements.—Mr. G. Braulik announces that the agency which has been held at different times by Messrs. Polland & Co., and also the Union Cable Company, Limited, for the well-known articles manufactured by the Elektrotechnisches Institut Frankfurt has now been passed into his hands solely, and all orders should be addressed to him at 218, Upper Thames Street. A large stock of the "Beez" pocket volt and ammeters will be kept by him.

Messrs. Aiton & Co., of 25, Laurence Pountney Lane, E.C., notify that after May 21st their address will be Western Works, Hythe Road, Willesden Junction, N.W.

Messrs. Fricker & Miller announce that they have ceased to carry on business as electrical contractors, and have commenced to practice at 82, Victoria Street, Westminster, S.W., as consulting engineers and electricians.

The Fuller-Wenstrom Electrical Manufacturing Company has opened offices at 110, Cannon Street, E.C., in consequence of expansion of business. All communications should be addressed there in future. Another notice relating to this matter appears in our "Notes" columns.

Two-Power Lamp.—An incandescent electric lamp with two independent filaments, one of high and the other of low candle-power, has appeared in America. The low power filament is chiefly used as a night light, and the change from one power to the other is made by turning the lamp in a screw socket. Similar lamps have been known in this country for years.

ELECTRIC LIGHT AND POWER NOTES.

Bournemouth.—The T.C. has resolved that on its inclusion with the borough, application be made for a prov. order for electric lighting for the present district of Pokesdown. The L.G.B. has granted sanction to borrow £11,978 for the purpose of public lighting.

Bulawayo.—The electric lighting plant of the Bulawayo Waterworks Company, Limited, is now being doubled in size.

Colchester.—A L.G.B. inquiry was held last week by Mr. W. O. E. Meade-King in respect of an application by the T.C. for leave to borrow £15,900 for electric lighting purposes. The electrical engineer, Mr. A. R. Sillar, explained that a sum of £1,970 5s. would be required for doubling the supply pressure. The rest of the loan was for extensions of plant and mains, and purchase of land.

Cork.—Last week, but for the electric light, the city would have been left in total darkness on Thursday and succeeding nights, owing to a strike amongst the employés of the Cork Gas Consumers' Company.

Dublin.—The Dublin Electric Lighting Committee met last week, when reports were read on the progress of the new electric lighting scheme. Thirty-eight tenders had been sent in under Specification No. 4, and were forwarded to Mr. Hammond for his report. A report from the sub-committee appointed to arrange as to the loan of £254,500 was submitted, and the Committee decided to send forward a recommendation to Council on the method of raising the loan.

Dumfries.—The report submitted to the T.C. by Mr. John Ritchie, of Messrs. Carrick & Ritchie, Edinburgh, on the practicability of utilising water for the electric lighting of the burgh, states that the only stream in the vicinity available for the production of power is the Cargen Water, about four miles from Dumfries. There is a total fall of 185 ft., and to make a practical scheme it would be necessary to utilise as much of the fall as possible. Mr. Ritchie considers that it would inadvisable for a town the size of Dumfries to entertain a water-power electrical installation unless 400 to 500 H.P. could be produced for the hours that the maximum amount of light was required. Suitable sites for a service reservoir capable of holding 200,000 cubic feet of water and a supplementary reservoir to hold 150,000 cubic feet are indicated. He estimates that a working head at the power house of not less than 150 ft. could be got, and to produce 500 H.P. under these conditions would require about 2,400 cubic feet of water per minute. The Cargen Water, made up of the overflow from other sources, with the addition of these two proposed reservoirs, is capable of producing 500 H.P. There should be two turbines of 250 H.P. each, one of 100 H.P. and one of 50 H.P., coupled direct to dynamos. Probably Dumfries will in a few years require at least 1,500 H.P. This would involve a steam generating station in or near the town, but there would be no difficulty in working a water-power and steam station in conjunction with each other. The estimated cost approximates to £11,000, exclusive of payment for land and wayleaves, and includes:—

	£	s.	d.
Cost of lade 1,200 yards long, lined where necessary, with culverts, fireclay pipes, overflow channel, tank, strainers, sluices, &c.	1,950	0	0
1,130 yards of steel riveted pipes, with flanged joints, 36-in. diameter, track excavated and filled, and pipes laid and jointed, including bends, curves, and branch pipes, to turbines	4,930	0	0
Two 250-H.P. turbines, one 100-H.P. turbine, one 50-H.P. turbine, with extended under-frame to take on the dynamos, sluice valves, governors, suction pipes, and other fittings, erected complete	1,480	0	0
Overhead crane	70	0	0
Power house, foundations for turbines, store, and other buildings	500	0	0
Deepening tail-race from power-house down to Clunie Bridge	80	0	0
80-H.P. oil engine, with foundations, &c., erected ..	400	0	0

The E.L. Committee, in view of the difficulties disclosed by Mr. Ritchie's report, on Tuesday resolved to recommend the Council not to entertain the idea of a water installation, and the town clerk was instructed to communicate with Dr. Mond, inquiring as to the applicability of the Mond gas to the generation of electricity.

Durban.—Mr. John Roberts, the borough electrical engineer, has recently prepared and published by order of the Corporation, a pamphlet setting forth for the enlightenment of the Durban public, the great advantages of electric driving. The electricity supply undertaking commenced operations late in 1898, but there are now over 700 consumers, and the outlook is so promising that it is anticipated that the number will be trebled by the end of the next three years. The Corporation electric trams will be operating with a 30-car service by about the end of the year. The pamphlet now before us contains a good deal of information relating to the subject which could not easily be placed before the local consumer in any other way. The advantages of electricity over other forms of power, and the comparative costs, also general details regarding the equipment of motor installation, are given by Mr. Roberts, and are followed with some precautions to be observed in a motor installation to prevent fire and shock. We wish Mr. Roberts continued and greater success, and hope that his circular will have the effect of bringing on a good day load.

Eccles.—The Public Lighting and Electricity Supply Committee of the Corporation has resolved to extend the electric lighting undertaking of the borough, but first to obtain the advice of an expert as to the feasibility of the work being carried out successfully. The Committee has decided not to entertain the offer of the Trafford Park Power and Supply Company to supply electricity in bulk.

Germany.—The municipal authorities of Aix-la-Chapelle have voted a sum of £50,000 for the extension of the electric light mains in the town.

Gillingham.—At a meeting of the D.C. last week the resolution passed by the Council not to purchase the New Brompton undertaking of the Chatham and Rochester Electric Lighting Company was rescinded, and a resolution to purchase it under an agreement entered into by the company, Mr. Henry Jasper, and the Council, was carried.

Glasgow.—The following is the revised scale of charges recommended by the Electricity Committee for the year 1901—1902:—

For Lighting Purposes.—(1) Shops, warehouses, offices and all other premises except those specified under heads 2, 3 and 4, to be charged on the demand indicator system at the rate of 6d. per B. of T. unit for the first 365 hours' use per annum of the maximum demand, and for all energy consumed over this quantity 1d. per unit for 250-volt, 1½d. for 200-volt, and 2d. for 100-volt supplies respectively. (2) Domestic rate.—3½d. per unit for 250-volt, and 4d. per unit for 200 and 100-volt supplies. (3) Theatres, halls and other places of entertainment.—3½d. per unit. (4) Churches.—3d. per unit.

For Motive Power Purposes.—A uniform rate of 1½d. per unit for 250 and 500-volt supply, and 2d. per unit for 200-volt supply, subject to the conditions already in force for the proper protection of the Corporation. It is not proposed to make any alterations in the rates charged for energy supplied under existing special agreements and for the lighting of public street lamps. At the Council meeting on the 15th inst. it was agreed to defer confirmation of the above charges till next fortnightly meeting.

Hampton (Middlesex).—The B. of T. has granted an electric lighting prov. order to the U.D.C.

Hexham.—The T.C. has instructed Messrs. Lacey, Clirehugh & Sillar to prepare a report on a combined scheme for lighting and traction, dealing with the advisability of the utilisation of water for motive power.

Hoylake (Cheshire).—At the meeting of the Hoylake and West Kirby D.C. on Monday, the chairman, in moving the adoption of the minutes of the Electricity Committee, stated that by the end of the week electric light and power would be available all over the district.

Kingston.—The L.G.B. has sanctioned the borrowing of £17,800 by the Corporation for electric lighting purposes. The tender of Messrs. F. & E. Davey has been accepted for the building of a chimney shaft at £1,989.

London.—KENSINGTON.—At a meeting of the Borough Council last week a report by the Street Lighting Sub-Committee was discussed. In the report it was stated that the lighting engineer had submitted plans and estimates for lighting some of the main roads by electricity, after consideration of which the Committee had inspected the lighting at a number of places. In Hammersmith and Wimbledon they viewed two or three systems of street lighting by incandescent electric lamps, but did not consider that this system possessed any advantages over the incandescent gas lighting adopted in Kensington. The Committee had come to the conclusion that arc lamps erected about 60 yards apart on each side of the road alternately, and on posts 20 ft. high, fitted with swan necks, so that the lamps hung a few feet over the roadway, were the most suitable. Having regard to the great and rapid improvements now being made in public lighting by oil, gas and electricity, they were of opinion that the last was preferable, and suggested a further and more extended experiment with arc lighting in certain main roads, and extending the use of incandescent gas lighting in other thoroughfares. The Council decided to further consider as to the lighting of the following streets with electric arc lamps:—Kensington High Street and Kensington Road, Brompton Road, Holland Park Avenue, and High Street, Notting Hill. The cost of lighting these streets was estimated at £3,900.

POPLAR.—The Borough Council has resolved to carry out extensions of plant and mains, as recommended by the engineer, at an estimated cost of £52,348.

SOUTHWARK.—The City of London Electric Lighting Company has given notice to the Borough Council of its intention to apply to the B. of T. for a prov. order to supply electricity throughout the borough.

WESTMINSTER.—A fire took place in Conduit Street on 16th inst. in one of the electric manholes, apparently due to an accident to the electric mains. It was extinguished by firemen with water and sand.

L.C.C.—The report of the Improvements Committee of the L.C.C. submitted to Tuesday's meeting referred to the litigation with the Metropolitan Electric Supply Company on the subject of the reinstatement of the company's station in Sardinia Street, and to the decision of the Court of Appeal in favour of the company that it was open for the arbitrator to say whether or not any spare or stand-by plant was necessary. In the opinion of the Committee the case should be taken further, and they therefore recommended the Council to give notice of appeal, and to instruct the solicitor to take steps to protect the interests of the Council in connection with the proceedings in the House of Lords. The proposal was carried.

The L.C.C. has decided to authorise the erection of an addition to the air-compressor house at the generating station of the Charing Cross and Strand Company in Commercial Road, Lambeth.

The conference of local authorities of London to which we referred recently was held on 16th inst. to discuss the question of the supply of electricity in bulk. It was pointed out that several companies were seeking Parliamentary powers to undertake this work, and fears were entertained that the position would be endangered of those local authorities which had already entered the electric lighting business on their own account. The conference re-affirmed the resolution passed at a similar gathering three years ago, approving of a supply by the L.C.C. to local authorities of electricity in bulk. It was further decided that the Council be asked to draft a suitable Bill to be submitted for confirmation to the local authorities.

ISLINGTON.—The Borough Council is going to extend the electric lighting mains at a cost of about £5,353.

Lowestoft.—An inquiry was held last week by Mr. W. O. E. Meade-King, L.G.B. inspector, into an application of the T.C. for leave to borrow a further sum of £20,000 for electric light-

ing purposes. The loan was required for extensions of mains and plant, public lighting, strengthening the foundations of the electricity works, and building a concrete raft for the boilers and engines. A second loan of £10,000 for extending the supply to the whole of the borough will also be necessary.

Morecambe.—The accounts of the E.L. Department for the year ending March 31st show that the gross surplus on the revenue account was £1,604, against £1,765 last year. The total cost of the works and plant up to March 31st was £52,408, of which £3,943 has been repaid as principal. The sum actually expended has been £48,465. The value of the energy sold during the year was £4,530, against £3,916 last year. Despite this increase, however, there is a loss on the year, after repaying principal and interest to the amount of £2,281, of £677, against £9 last year. It has been decided to charge the pier companies 7d. per unit, as at present, but if the annual payment exceeds £250, the charge will be reduced to 5d. per unit for all consumed over this amount.

Norway.—An electric installation for lighting and motive power purposes has just been completed at Drontheim, Norway. The central power station, and the sub-stations with turbines, have necessitated an outlay of 200,000 crowns, while the installation of wires overhead and underground has cost nearly 250,000 crowns. The hydraulic force which actuates the installation, is secured from a waterfall at Lerfossen, which is about 8 kilometres from Drontheim. The central power station is provided with two machines of 1,000 H.P. each, but steps are being taken with a view to raising the total power of the installation to 12,000 H.P. The three-phase current is produced at a tension of 7,000 volts, and is conducted to the town by means of aerial wires supported by poles. On entering the town the canalisation becomes subterranean; one line supplies the sub-station, which is used for the electric tramway service, while the other is conducted to the transforming stations situated at different points in the town. In the latter, the current is reduced to 150 volts, and distributed to consumers by subterranean cables. The tramway, which is a trolley system, about 3,600 metres long, utilises continuous current at 500 volts. The initial cost of the tramway was about 300,000 crowns.

Oxford.—The governing body of Christ Church have decided to carry out an electric lighting scheme drawn up by their consulting engineer, Mr. Morgan Williams. The contract has been placed with Messrs. Hill, Upton & Co., of Oxford.

Perth.—The T.C. has placed an order for 150 watt-hour meters with the British Thomson-Houston Company, and demand meters are to be obtained from the Reason Manufacturing Company, Limited. June 1st has been fixed by the T.C. for the formal opening of the electricity works.

Peterborough.—The L.G.B. has given its sanction to the obtaining of a further loan of £12,200 for electric lighting purposes. Of this sum £5,000 is required to complete the present works, £6,000 for extensions (plant and mains), and £1,200 for street lighting.

Pietermaritzburg.—From a report drawn up by a committee of the Ratepayers' Association on the electric lighting of the city, it would appear that the Corporation has spent £71,000 on electric lighting, and that this sum was not raised by special loan, but was "borrowed" from funds raised for other public works. The T.C. is now applying to the Legislature for sanction to an electric lighting loan of £200,000, out of which the above sum will be repaid. According to the Committee's report, the electricity accounts should have shown a loss of £2,401 on the last year's working, instead of declaring a profit of £125.

Portsmouth.—Coal has cost the E.L. Committee £4,000 more this year than last year, though the output has not largely increased. It is now buying "dust" locally at 12s. for which a few months since it paid 18s. 9d. per ton. The Committee has considered tenders for five additional Lancashire boilers, two feed pumps, mechanical stokers, economisers, steam feed and other pipes, and recommended that the tender of Messrs. Yates & Thom (£6,950) be accepted. It was explained that this was not the lowest, but that there were reasons which induced the Committee not to recommend the latter. It was stated that the mechanical stokers had been so great a success that the Committee had unanimously resolved to recommend a continuance of their use. The report was adopted.

Shrewsbury.—The report of the Lighting Committee states that the energy sold has increased 76 per cent in 12 months, and that preparations are being made for fixing a new engine and dynamo. To meet the increasing demand, the Committee recommended a further loan of £16,526, as it was absolutely necessary that additional cables should be laid, and an increase of £50 a year in the salary of the electrical engineer. The report was adopted.

Waterhouses.—Messrs. Pease & Partners are making arrangements for lighting the Waterhouses and Esh districts by electricity.

Wearside Shipyards.—Until recently electricity was practically unknown as a motive power in the different shipyards on Wearside. Latterly this agent has been coming more to the fore than formerly, and electricity has in many cases replaced steam in the driving of punching and shearing machines, angle-bar cutters, counter-sinking machines, rollers, drilling machines, turning lathes, planing machines, grindstones and cranes. The application of electricity to the small drilling machine has been a matter of great convenience, for however cramped the position may be in which the tool has to be worked, it is easy to carry the necessary wires there safely and practically without cost. Most of the engineering and shipbuilding yards on the Wear are now using electricity to some extent in lieu of steam, as well as for lighting.

Willesden.—The Board of Guardians has appointed Mr. Morgan Williams consulting engineer to the new Willesden Infirmary.

Worcester.—Colonel Durnford, R.E., L.G.B. inspector, held an inquiry last week respecting an application by the Worcester City Council for sanction to borrow £4,950 to purchase a site for an additional street-lighting station, and for purposes of electric lighting.

ELECTRIC TRACTION NOTES.

Belgium.—The unification of the Antwerp tramways with prolongation of concession till 1945, and the application of electrical traction to the entire system, has been approved of by the Belgian Chamber. The measure has still to be passed by the Senate, but this is already more or less a foregone conclusion.

Blackburn.—Although the official report in detail of the Blackburn electric tramways working for the past year has not yet been made public, Alderman Thompson, the chairman of the Electricity and Tramways Committee, states that there has been very considerable loss upon that undertaking. Though there has been a great increase in the number of passengers since the introduction of penny fares, the financial results are not so satisfactory as was anticipated, and the receipts have fallen far short of working expenses, interest on loans, and sinking fund. The deficiency amounts to about £3,800, and Mr. Giles, the electrical engineer, has suggested the desirability of raising the fares from 1d. to 1½d., on all routes except the Witton section. This proposal is now under consideration by the Committee.

Brighton.—The contractors for the permanent way for the Corporation tramways, Messrs. Macartney, McElroy & Co., Limited, are now laying the rails at about the rate of half a mile of single track per week. The first consignment of poles has arrived from Messrs. Blackwell & Co., and all other branches of the work are being pushed on with the utmost haste; there is every prospect of the lines being ready for operating about the middle of next September, as previously arranged.

Brighton and Rottingdean Seashore Tramway.—In consequence of the Corporation being compelled to remove some of the rails of the Seashore Tramway, in order to extend one of their groynes, they have allowed a temporary timber gangway to be erected on the Blackrock groyne to act as a landing stage for the seashore car during this summer. Mr. Volk has also obtained permission to extend the beach tramway from the "Banjo" groyne to the Blackrock groyne, thus forming a connecting link between the seashore and the beach tramways.

Canada.—The statistician of Canada has compiled some interesting figures regarding the 34 electric railways of the Dominion. During the year ended December 31st, 1899, 630 miles of track were used, and the total number of miles run by cars was 29,646,847. Passengers carried numbered 104,033,659, which was equal to carrying every man, woman and child in the Dominion 20 times. Compared with the previous year, the number of passengers increased nearly 9,500,000, and the number of miles run over 1,000,000. The amount of paid-up capital invested in electric railways is $21,700,000.—*Scientific American.*

Central London Railway.—At the Surveyors' Institution, Mr. Daniel Watney, sitting as sole arbitrator, heard the case of Pearce *v.* Central London Railway Company, a claim for compensation in respect of certain damage to the vicarage of Christ Church, Newgate Street, E.C., alleged to have been caused by the construction of the line. Evidence having been heard, the arbitrator reserved his award.

Cork.—The Cork Electric Tramways and Lighting Company in the first four months of 1901 had £600 increase over the earnings in the corresponding period of 1900. Last year they carried 5,137,000 passengers, or the whole population of the city 64 times over. Passengers are carried as far as 3⅓ miles for 1d., and lighting is done for 4½d. per unit; so the people of Cork are getting a remarkably cheap service. The traffic receipts were £1,774, and the lighting receipts £4,178 over the previous year.

Glasgow.—The Corporation has resolved :—

That it be an instruction to the conveners of the Watching and Lighting and the Tramways Committees to consider the question of possible demands on the police in the event of accidents to overhead wires on tramway routes, and the equipment of the police for same, and to report.

Glasgow.—Eleven accidents caused more or less indirectly by the new electric cars occurred last week, one proving fatal.

Howth.—On June 1st the new Hill of Howth tramway will be opened. The power station is at Sutton, where there are three dynamos of 250 H.P. each, these being coupled direct to three steam engines. The cars have all up-to-date improvements, and are fitted to accommodate 30 passengers inside and 37 on top. The engineer of the Great Northern Railway, Mr. W. H. Mills, had entire control of the construction of this tramway line.

Kearsley.—The U.D.C. has authorised Messrs. Lacey, Clirehugh & Sillar to prepare specifications for the complete equipment of the tramways.

Lancaster.—The Tramways Committee has considered proposals submitted by a Birmingham firm for the acquisition of the powers obtained by the Corporation last year for the construction of tramways, the object of the syndicate being to establish between Lancaster, Morecambe, and district a network of electric tramways. It was proposed to acquire the undertaking of the present tramway company with an offer larger than that made by the Corporation. The proposal was unanimously declined by the Committee.

Leicester.—Mr. E. Manville, of Westminster, in accordance with instructions from the T.C. to consider and advise as to the best system of electric traction to be adopted for Leicester, has just recommended (1) the adoption of the overhead trolley system of electric traction, and (2) to erect a separate power station for the purpose of tramways on the "Lero" site. Mr. Manville's report deals with several questions which were submitted to him in consequence of objections to the scheme which were raised at the meeting of the Council. The present report entirely supports the recommendations of the Tramways Sub Committee, and embodies the scheme which was prepared by Mr. E. G. Mawbey, the borough engineer and surveyor. The full Tramways Committee has now unanimously recommended the original scheme to the Council, and also that the surveys, detailed plans, &c., for the lines, power station, depôts, &c., be prepared by Mr. Mawbey, with Mr. E. Manville acting as the consulting engineer. The matter came before the Council on Tuesday last, when there was a lengthy debate, and the report was adopted with the exception of the power station site. Mr. Manville was appointed consulting engineer.

Liverpool.—Through the jambing of a trolley head at one of the sharp turns on the Liverpool electric car system, in Tithebarn Street, on Tuesday morning, a length of the overhead trolley wire fell, striking the car in its fall. Fortunately, no one was injured. The current had to be shut off from the section, and a stoppage of the traffic for about half an hour occurred. The stoppage affected the main city stream of traffic along Dale Street, there being for a time an unbroken line of tramcars for its entire length.

The Lizard.—The scheme for running an electrical light railway to the Lizard, instead of a steam line as originally intended, came before the Heston R.D.C. some days ago. Mr. Silvanus Jenkyn, of Liskeard, the engineer of the scheme, explained that the trolley system was proposed.

London United.—The L.U.T. Company has been delayed not only by the Kew authorities, but by Scotland Yard. Application was made for 200 drivers to be licensed, but unconscionable delays occurring, Mr. Clifton Robinson allowed some unlicensed men to get to work. He was accordingly fined 10s. with costs. If he can get matters moved a little more satisfactorily, it will be worth a good many half-sovereigns to his own and other tramway companies. There are quite enough troubles for the tramway promoter to contend against, without the police joining the ignoble band of opponents.

Middlesex.—The *London Gazette* for May 21st, contains notices of applications to be made by the Middlesex County Council for powers to construct light railways under Extensions Orders Nos. 1, 2, 3 and 4.

Portsmouth.—Sir Frederick Bramwell has issued his award in connection with the taking over of the tramways by the Corporation. The price to be paid by the latter to the Provincial Tramways Company is £185,633.

London.—At Tuesday's meeting of the L.C.C. the Highways Committee expressed confidence that it was the desire of the Council that the work authorised by the London County Tramways (Electrical Powers) Act, 1900, of reconstructing the tramways for electric traction should be pushed forward as soon as possible. With that object in view the question had been considered of making arrangements for the conversion of other sections of tramways at the same time as the work of reconstruction of the lines between Westminster Bridge and Tooting, Blackfriars Bridge and Kennington Park, and Waterloo Road and St. George's Circus. After due consideration the Committee had come to the conclusion that the tramways next to be dealt with should be those (1) between the junction of Kennington Road with Westminster Bridge Road and St. George's Circus; (2) the Elephant and Castle and along the New and Old Kent Roads, New Cross Road and Greenwich Road, to the terminus at Trafalgar Road, Greenwich; and (3) the Elephant and Castle *viâ* Newington Causeway to St. George's Church, and thence *viâ* Dover Street to the junction of the New and Old Kent Roads. The total length of those tramways was nearly seven miles of double line. The chief engineer had been consulted on the subject of the work being proceeded with without unnecessary delay, and as a result the committee suggested that in order that full advantage might be taken of the experience of the various firms of contractors who execute such work, the specifications should be drawn up in such a manner as to allow the parties tendering to include their own details of conduit construction. The interests of the Council would be fully safeguarded by the general conditions usually attached to the contracts, and the issue of a detailed specification with quantities of the track rails, the conductors, and the road work; but instead of a particular design of yoke and insulator being specified, and tenders according to that design only being asked for, parties tendering would be at liberty to submit their own designs. This practice was usual with regard to other kinds of work; indeed, it was adopted by the Council with regard to the tenders recently invited for the supply of the boilers and stokers required for the generating station to be erected at the Camberwell tramways depôt; in which instance working drawings were not issued, but the results desired were clearly specified, and the parties who tendered submitted their own details. The Council decided to authorise the Committee to prepare specifications and to invite tenders for the construction of the above-mentioned lines on the basis suggested in the report.

Scarborough.—The B.E.T. Co. has submitted proposals for the introduction of electric trams.

South Shields.—Negotiations between the Corporation and a company with reference to electric trams have come to nothing, and the Tramways Committee will again consider the scheme for municipalisation.

Wolverhampton.—On Monday Alderman C. T. Mander (chairman of the Tramways Committee) in the presence of a large number of the burgesses, formally broke a portion of the ground on Tettenhall Road, at its junction in Newhampton Road, West, preparatory to the commencement of the laying of the new tramways. The contractor, Mr. Holloway, presented Alderman Mander with a beautiful silver salver as a memento of the event. Subsequently the work of construction was commenced in earnest, the first load of rails being brought to the spot before the company separated. The rails are being supplied by the Leeds Steel Works; each is 60 ft. long and weighs 91 lbs. to the yard.

The Tramways and Light Railways Association.—At a recent meeting of the council of this association, the question of Earth Returns and the Joint Committee Clause of 1893, was considered, especially with reference to the Sheffield Corporation Tramways Bill. In addition to the Joint Committee Clause, the Sheffield United Gas Company has recently caused to be inserted a further clause in the Sheffield Corporation Tramways Bill, with a view to protection against electrolysis from earth return currents. It was unanimously felt that this additional clause, if allowed to remain in the Bill, would create a precedent extremely onerous and unfair to promoters of electric traction undertakings. The secretary was therefore instructed to call a conference, when the Council of the Tramways and Light Railways Association and the Earth Returns Committee of the Electrical Section of the London Chamber of Commerce, should have an opportunity of discussing the whole matter with promoters of electric traction Bills coming up during the present session. It is hoped that one of the results of this meeting will be to take immediate action to get the additional protective clause withdrawn from the Sheffield Corporation Tramways Bill. The question of affiliation of the Northern and Midland Counties Association of Tramway and Light Railway Officials, which held a most successful inaugural meeting in Sheffield recently, was again before the council. It was decided that a deputation be formed, consisting of Mr. Garcke and Mr. Philip Dawson, who should wait upon the council of the association with a view to arranging some definite lines for affiliation. Much regret has been felt by this association that the President of the Board of Trade has not been able to embody in the new Light Railways Bill more of the suggestions laid before him by the deputation from this association, which waited on him on February 28th last. The association still hopes, however, to get certain additional clauses inserted in the Bill when it comes up in the House for the next reading. Mr. Vesey Knox had drawn up some amendments, which were discussed at the Council dinner, and it was agreed that Mr. Atherley-Jones, K.C., M.P., should be responsible for the moving of these amendments in the House at the right occasion. It is not yet decided whether to hold the annual dinner in London at the end of June or in Glasgow in September. In view of the Glasgow Exhibition and the fact that the International Engineering Congress will take place in Glasgow next September the latter date is considered preferable. Arrangements have been made with the British Association for the reading of papers before Sections F and G by members of the Tramways and Light Railways Association. Mr. E. F. Vesey Knox, M.A., will read a paper before Section F on "The Economic Effect of the Tramways Act, 1870." Mr. A. H. Gibbings, M.I.E.E., engineer-in-chief of the South Lancashire Electric Traction and Power Company, will read a paper before Section G, but has not yet fixed the title. The total membership of the association is now 214.

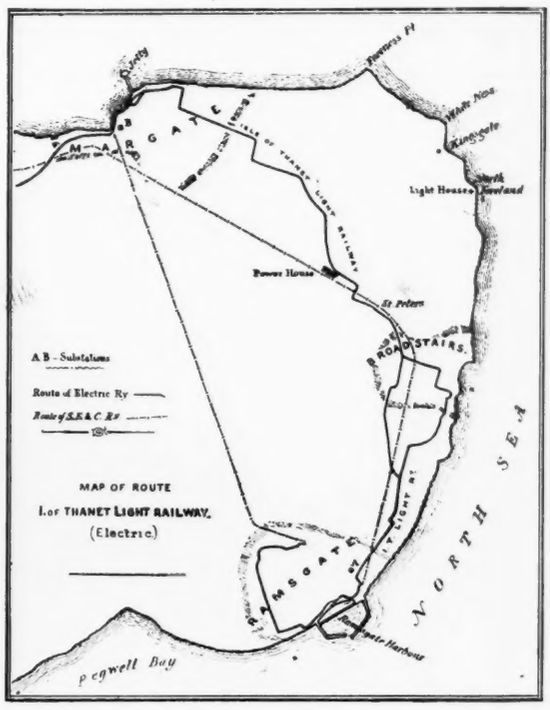
Yarmouth.—At last week's Council meeting the Tramways Committee recommended that tenders be invited for 14 double-decked cars. The Committee also recommended the Council to fix single-armed poles at the sides of the streets other than the Marine Parade and Northgate Street, which were to have double-armed poles placed in the centre of the roadways. A letter was read on behalf of the British Electric Traction Company, stating that they were desirous of carrying into effect the Yarmouth and Gorleston Tramways Provisional Order of 1897, authorising the equipment of the line for electric traction, which they were empowered to effect with the consent of the Corporation, and which consent they now applied for, and also inquiring upon what terms the Corporation would be willing to supply the necessary energy. If the company's application was favourably entertained, they would be prepared to discuss the terms upon which the tenure of the undertaking might be renewed. It was recommended that the Town Clerk be instructed to reply that although the Corporation do not see their way to entertain any proposition having for its object the extension of the term which expires in 1904, they will nevertheless be prepared to consider any proposal the company might be willing to make for giving the Corporation an early opportunity of acquiring their undertaking. The latter portion of the report was adopted, but the matter of the electric car tenders was referred back to the committee.

ISLE OF THANET LIGHT RAILWAY.

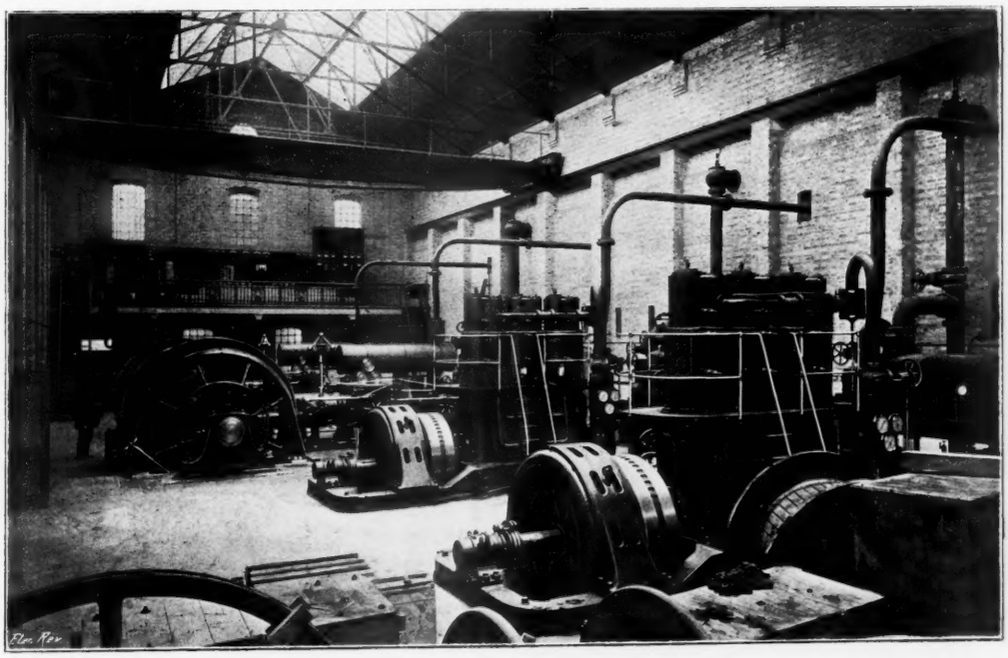
Few districts are so well adapted to, and, until recently, were in such great need of, the benefits of electric traction as that which includes the popular holiday resorts of Margate, Ramsgate, and Broadstairs; and having in view the progressive and practical characteristics of the local authorities of these townships, one would have supposed that they would heartily welcome the proposition to couple them together by the construction of a light electric railway. Yet so strong was the local opposition to the project when it was brought forward at the end of 1896, that the Light Railway Commissioners, in May, 1897, adjourned the matter indefinitely. The promoters, however, chief of whom was Mr. W. M. Murphy, were not disheartened; by means of protracted negotiations, they succeeded in bringing about an agreement, and the project received the sanction of the Board of Trade in August, 1898. Work was started in May, 1899, but was greatly retarded by the construction of new roads, &c., and by the necessity of stopping the operations during "the season."

Steam Piping and Economiser.

It is safe to say that, in proportion to the total length of line, 11 road miles, no district has had so many good and new roads laid for it by the tramway promoters as this under consideration, there having been at least two and a half miles of 42 and 60 ft. roads constructed; while at Broadstairs the entrance to the town—or village—has been considerably improved, the main road having been widened 12 ft. This entailed the widening of the railway bridge which crosses the road here, and, as the headway under the bridge was inadequate, the road was lowered some 2 feet. An alteration of the levels of 250 yards of sewer also became necessary.



Map of Route.

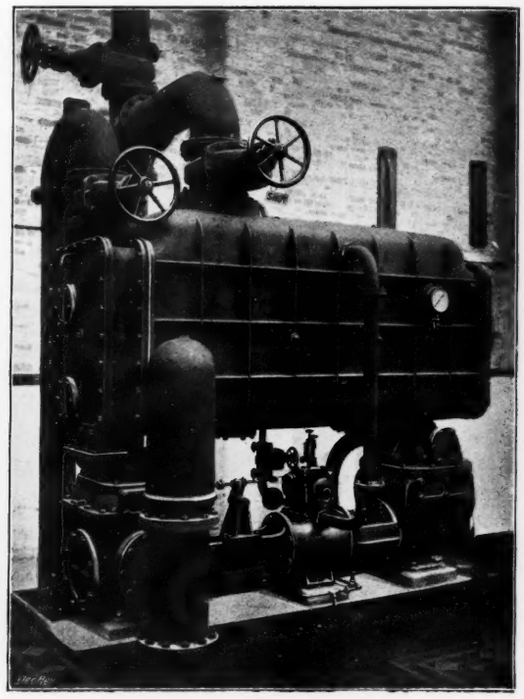


General View of Engine Room.

The line of route, starting from Canterbury Road (which is

the main road from Birchington to Margate), passes along Margate Front, and after mounting Fort Hill for 100 yards at a grade of 1 in 12 it turns off the Front, up Athelstan Road, and works out to St. Peters along new roads through

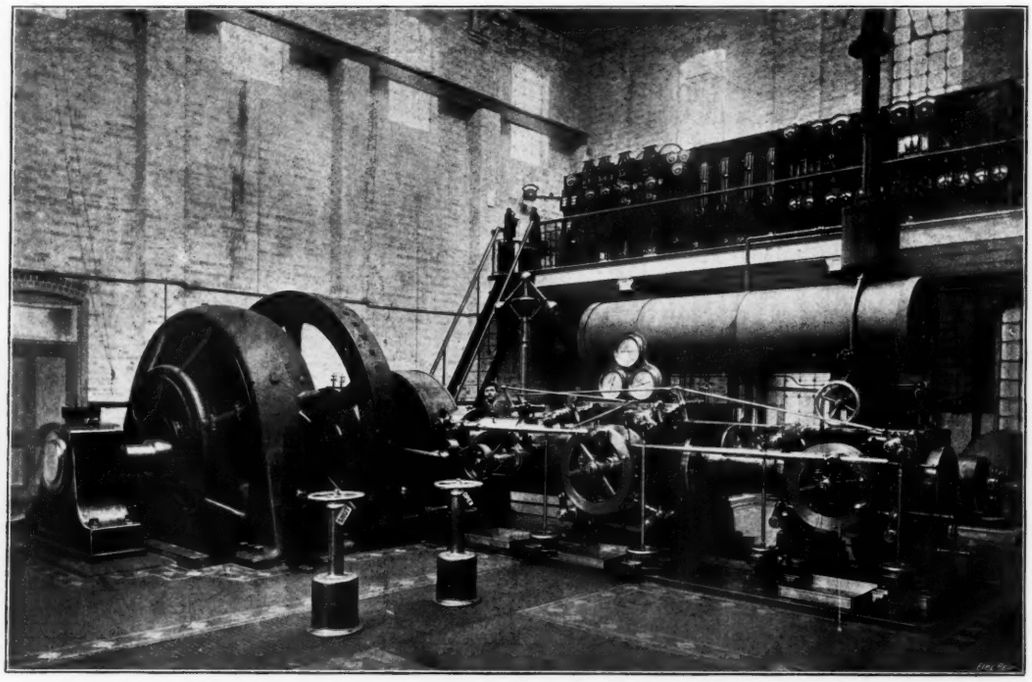
Centre and Side Poles, Margate Promenade.



Wheeler Surface Condenser.

fields; here it passes the power house on the right, and running parallel to the Chatham and Dover Railway, it eventually reaches Broadstairs station. Here the line divides, one track going down hill to the Parade and across the fields to rejoin, near Dumpton, the other track, which maintains a straighter course on the higher ground. From this junction the rails head towards Ramsgate Harbour, which is reached after descending by a double S, a hill, the grade of which is 1 in 18. A side road along the quay has been laid with a view to conveying coal for the use of the power station; it is here also that that part of the line known as the Ramsgate extension starts, its terminus being the South-Eastern Railway station past a pleasure resort called Ellington Park.

The track itself, the gauge of which is 3 ft. 6 in., is mainly double, and wherever possible it has been laid interlacing in preference to single; this does not include the portion through Broadstairs, which is single, with frequent loops. The rails used are the Lorain Steel Company's 83 lbs. per yard **T**-rails, with Askham Bros. & Wilson's spring



Allis Engine and B.T.H. 200-kw. Dynamo.

points and Murrel's crossings; they are well bonded throughout by Neptune and Chicago 0000, B. & S. gauge, bonds. In the towns wood paving has been used between the rails; in other places ordinary granite paving at each side of the rail was regarded as sufficient.

The overhead wire is of No. 0 B. & S. gauge, carried by ears and hangers supplied through Messrs. Blackwell, while the poles are of mild steel in three sections, and are placed at the side, except for 1½ miles of centre pole construction along Margate Front, and in the fields just before reaching Ramsgate. Section boxes are placed every half mile, and are of the type usually supplied by the British Thomson-Houston Company, being fitted with two main switches, four feeder switches, pilot terminals and a telephone.

Battery of Babcock and Wilcox Boilers.

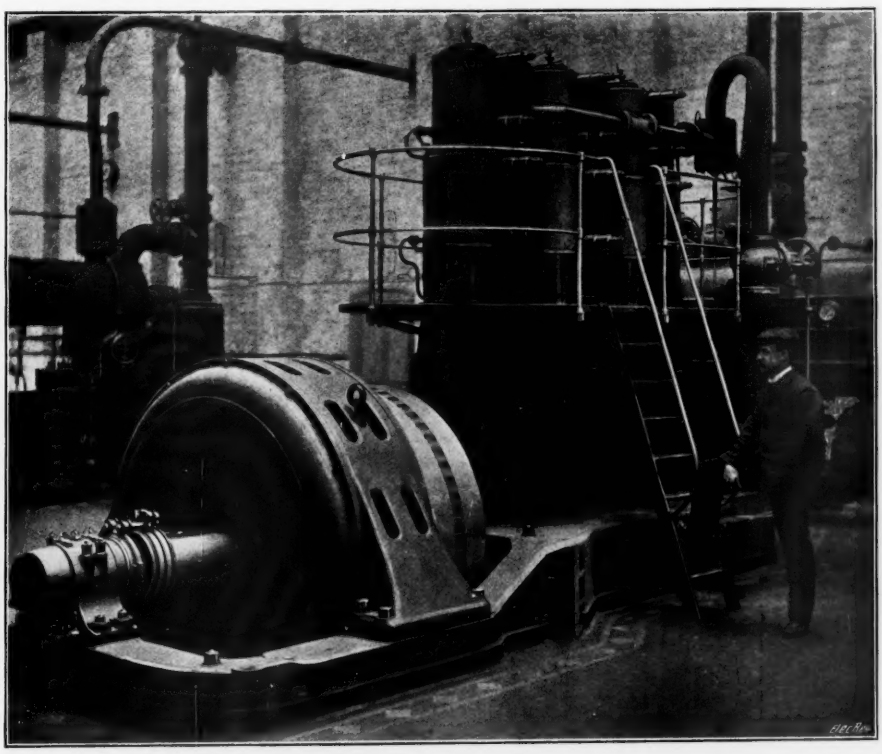
The cars, which are of the double-deck type, with glazed vestibules and reversed stairways, were constructed by the St. Louis Car Company, and are of two kinds, 20 double bogie cars and 20 single. The former are 21 ft. long inside, the total length being 32 ft. 4 in.; the clear height inside of the centre is 6 ft. 4 in., width 6 ft. 6 in. and length of each platform 5 ft. 3 in. The interior is finished in quartered sawn oak with longitudinal seats upholstered in plush, the second story being equipped with garden walkover seats. Where metal fittings are used they are of bronze. The single truck cars are similar to the others except in the length, which is 17 ft., and 28 ft. 4 in. overall. All the cars are painted chocolate and yellow with gold and silver lines. The trucks, which were also supplied by the St. Louis Company, are finished in chocolate and yellow.

The electrical equipment was provided by the British Thomson-Houston Company, and is as follows: — Two G.E. 58 motors, B. 18 controllers and maximum and main cut-outs, and the trolley standards, which are fairly short and placed at the side of the car. The motorman has also a gong pedal, sand lever and hand brake to attend to, the latter being fitted with Kelsey's patent ratchet handle.

The car shed, which is situated at the power house, is of two bays, each with four runways, with the usual repairing and painting sheds adjoining.

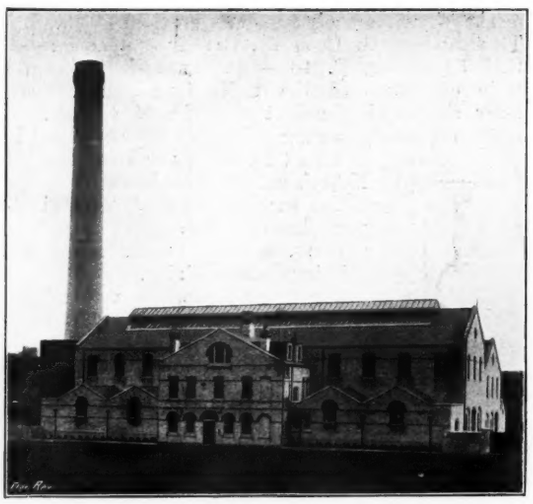
The power house is a very substantial building in white brick, with excellent offices, and at the east-end is the brick stack, of circular section on a square base, its height being 160 ft. and diameter 9 ft. 6 in. At one side of it is a Barnard cooling tower, of sufficient size to deal with 70,000 lbs. of steam per hour, with two sets of fans driven by two direct coupled 17-H.P. G.E. 500-volt motors at 235 revolutions per minute, and on the other side a 10,000-gallon storage tank, Desrumaux water purifier, and a 10-in. cylinder 24-in. stroke Worthington steam pump, which is placed over the company's own well, whence an efficient supply is expected, the local water supply being laid on as a reserve.

The pump room contains two Blake and Knowles 8-in. and 5-in. by 12-in. duplex ram feed pumps, a Railton and Campbell filter, and the hot well. There is a 240-tube economiser by the Clay Cross Company. The boiler house contains four Babcock and Wilcox boilers, each having a heating surface of 3,140 sq. ft., and working at a pressure of 150 lbs. per sq. in. On the dividing wall, between the engine and boiler rooms, are carried the atmospheric exhaust pipe, and the main and auxiliary steam headers, the latter being equipped with Geipel steam traps. The arrangement of the boilers and steam pipes is shown in our illustrations.



Belliss Engine and B.T.H. 300-kw. Three-phase Alternator.

The engine room has been designed with ample provision



Exterior of Power Station.

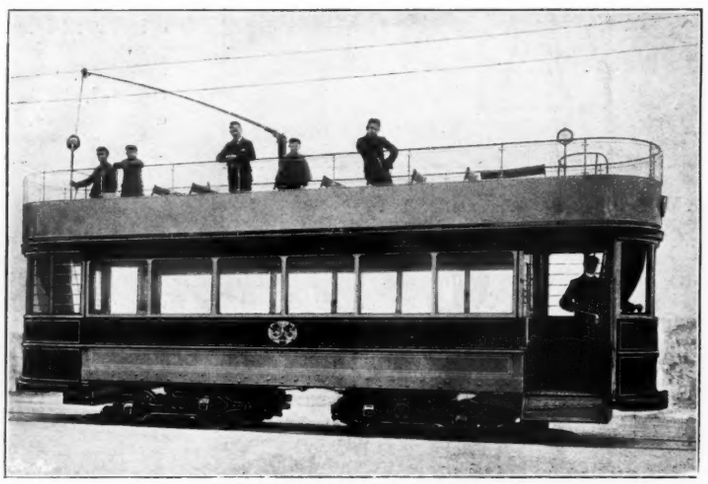
for extensions. The plant includes two Belliss & Morcom self-lubricating engines, 9½ in. and 17¼ in. by 12 in., running at 300 revolutions per minute, direct coupled to B. T. H. three-phase alternators of 50 cycles, mesh connected, and generating a line current of 60 amperes per phase at 2,500 volts (300 KW.). There are also two direct-current generators, supplied by the B.T.H. Company, of the multipolar type, giving 400 amperes at 500 volts at 135 revolutions per minute, and direct connected to two E. P. Allis horizontal tandem Corliss compound engines with Reynolds valve gear, the cylinder dimensions being 14 in. and 28 in., with a 30-in. stroke. The remaining electrical plant consists of a motor transformer with two generator armatures, each giving 120 amperes at 85 volts, and a balancing set for lighting purposes.

Three Wheeler condensers, each having a cooling surface of 1,300 square feet, and capable of condensing 13,000 lbs. of steam per hour, are ranged on the floor level over the circulating discharge and suction pipe trench, and two Allis engines exhaust into one, while each Belliss engine has its own. All four engines are connected with the atmospheric exhaust through Schutte non-return valves.

The switchboard gallery, which is situated at the end of the room, carries a combined high and low-tension traction and lighting board, and was supplied by the British Thomson-Houston Company; it is made of black enamelled slate, and consists of the following panels:—A Board of Trade panel, fitted with the usual Elliot recording instruments; two traction feeders with one Thomson watt-hour meter measuring the total output to the tramways; two generator panels with throw-over switches for supplying either the traction or lighting bus bars; a booster panel; Nos. 1 and 2 battery panels with sliding contact regulators, giving a range of 40 volts on each battery; positive lighting feeder fitted with plug bars, as are all the remaining direct-current panels, each lighting feeder having, in addition, its own controlling switch; positive battery panel; positive balancer; neutral panel, with vertical ammeters on the Van Vleck system—this last panel is also fitted with voltmeters to measure the potential at the different feeding points; negative balancer panel, negative battery, and negative lighting feeder panels. All these are fitted with Weston instruments, and Thomson watt-hour meters on the lower half of the panels. The high-tension board is made up of two generator panels and four feeder panels. The generator panels are fitted with Parshall three-phase H.T. switches, three Thomson ammeters, one in each phase, a Thomson voltmeter, a field ammeter, synchronising lamps, and a field switch. The feeder panels are fitted with oil-break switches and with watt-hour meters.

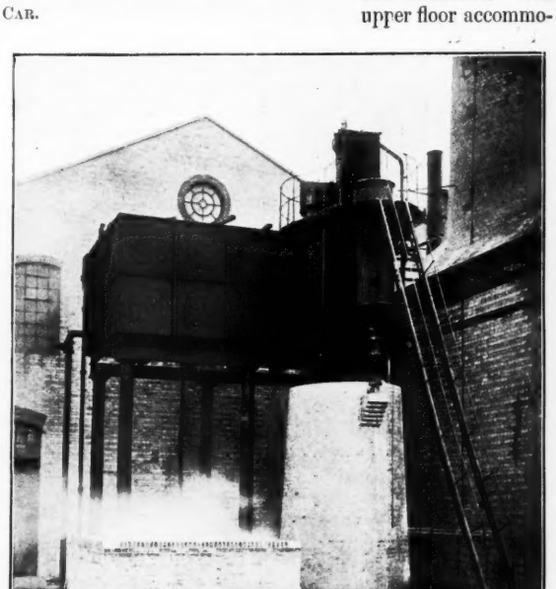
It should be mentioned that the exciting current is obtained from the batteries. The latter are two 500-volt sets, supplied by the Tudor Battery Company, and are of the L.A. 9 type, each battery having a 250 ampere-hour capacity and a discharge rate of 50 amperes for five hours.

The Ramsgate sub-station, which is a single-floor building, conveniently situated near the main line, contains two 100-KW. compound wound rotary converters, each with three (2,500/310 volts) transformers of 35 KW. capacity, with potential regulators. The switchboard comprises the following panels: Two H.T. feeder panels, six transformer panels with high and low-tension three-phase switches, two rotary panels, two L.T. feeder panels and a B. of T. panel. No provision has been made for lighting, the local Council having their own order.



St. Louis Bogie Car.

The sub-station at Margate, where lighting powers have been secured, is a more extensive building of two storeys, the ground floor being occupied by 12 transformers similar to those at Ramsgate, four rotaries, a 3-KW. machine consisting of 1 motor with booster on each side for battery charging, and two balancers. The upper floor accommodates a 265-cell Tudor battery, the capacity of which is 500 ampere-hours and the discharge rate 100 amperes



Water Storage Tank and Purifier.

for five hours. The switchboard here is a somewhat complex one, and is arranged as follows, starting from the left:—Two H.T. feeder panels, twelve transformer panels, two direct current traction feeder panels, four rotary panels, and the following lighting panels: two battery and booster, six positive feeder, neutral panels with two neutral feeders and six negative feeder panels.

The whole of the electrical equipment was supplied and erected by the British Thomson-Houston Company, with the exception of the cables, the contract for which was placed with the British Insulated Wire Company, and is as follows:—The high tension feeder from the power house to the sub-stations is a three-core cable of a sectional area of ·05 square inch; the low tension feeder has an area of ·2 square inch, the pilot cable is of 7/22 S.W.G., and the telephone of No. 16 S.W.G., all paper-insulated and lead-covered.

The promoters still hope to carry out their original idea of continuing the line on from Margate to Westgate and Birchington.

Mr. Beverley Griffin acted as engineer on behalf of Mr. Murphy during the construction, while Mr. A. Salter rendered valuable assistance throughout the arduous and prolonged negotiations which were involved. Messrs. Kincaid, Waller & Manville were the consulting engineers, and were represented on the work by Mr. T. E. Etlinger; Mr. H. F. Parshall also advised on the electrical details. Mr. A. A. Tyler has been appointed general manager, and Mr. R. Humphries resident engineer.

We have no doubt but that the undertaking will prove to be entirely successful.

TELEGRAPH AND TELEPHONE NOTES.

Cable Communications Committee.—A meeting of this Committee was held last week, when evidence was given by Mr. J. Henniker Heaton, M.P., and Lieut. Carlyon Bellairs, R.N. The Committee have accepted witnesses, the engagements with whom will occupy their time till about the middle of June. But, says the *Times*, if any gentleman who has not as yet been communicated with desires to be heard by the Committee, he should apply to the Secretary, Cable Communications Committee, Treasury. Every application should be accompanied by a memorandum stating the points upon which the witness proposes to speak for the consideration of the Committee. Another meeting was held on Wednesday this week, when Mr. R. Kaye Gray gave evidence.

Chi-fu—Wei-hai-wei Cable.—In the House of Commons last Friday, says the *Times* report, Sir E. Sassoon asked the Secretary to the Treasury, as representing the Postmaster-General, whether a public tender for the construction of the Chi-fu—Wei-hai-wei cable was asked for; and whether he would explaid why, in the interests of the public service and in view of the terms granted to the contracting company, the Government did not undertake the construction and working of the cable. Mr. Austen Chamberlain, in replying, said:—The question of calling for public tenders was carefully considered, but it was found that the arrangements between the Chinese Government and the Eastern Extension and Great Northern Telegraph Companies as to landing rights in China, &c., rendered competition impossible. The Chi-fu—Wei-hai-wei cable forms a spur to the existing system of the Eastern Extension Company in China, and the advantages of having it worked by them under due restrictions as to the nationality of the staff, &c., are held to greatly outweigh any disadvantages resulting therefrom. The agreement provides for the termination of the working agreement at any time at short notice if the arrangement is found unsatisfactory. At the time the cable was laid the need for communication was urgent, and the Eastern Extension Company were in an exceptionally good condition to do the work expeditiously on behalf of his Majesty's Government. I should like to add that we have every reason to be satisfied with their readiness to meet our wishes.

Dundee Telephones.—This week a deputation from the Dundee T.C. was to proceed to Glasgow to carry out investigations into the Corporation telephone system, with the view to a similar scheme being laid before Dundee T.C.

Indian Telegraph Rates.—In the House of Commons on 17th inst. Sir E. Sassoon asked the Secretary to the Treasury whether, in view of the fact that the reduction in the Indian telegraphic rate is being delayed in consequence of the obstruction offered by Germany, he would state the reasons which militate against the grant to the German Post Office of the right to land their Emden New York cable at Waterville. Mr. Austen Chamberlain, in reply, said that the cable of the German Post Office from Emden to the West of Ireland at present lands at Valentia. Germany has no cable of its own between Ireland and New York. The question of the transfer of the landing place from Valentia to Waterville is at present the subject of negotiation, and it would not be expedient that any statement should be made on the subject.

Indian Telegraphs.—Some experiments with high-speed telegraphy have recently been carried out between Bombay and Calcutta.

London Telephones.—In the House of Commons last week Mr. Banbury asked the Secretary to the Treasury, as representing the Postmaster-General, if he would press forward the work of laying the telephone wires which has now been going on for nearly a year; and also give instructions that all pipes and materials shall be unloaded at night, as at present the streets are nearly impassable, and when unloading is going on are quite impassable. Mr. Austen Chamberlain said that the work of laying the telephone wires in London was being pressed forward, and that most of the main lines had already been completed. The Postmaster-General understood that the unloading was done early in the morning, but he would made further inquiries if his hon. friend would give him particulars of the time and place of any obstruction of which he complained.

New Telegraph Cables.—The Durban correspondent of the *Standard* stated on 16th that the Eastern Telegraph Company's cable ship *Anglia* had arrived there with 1,800 miles of the first cable between Durban and Australia. The shore end was laid that morning, and it is expected that the first section to Mauritius will be completed this month. The cable will establish, for the first time, direct communication between South Africa and Australia.

The Paris correspondent of the same paper says that the *Echo de Paris* calls attention to the completion of two new French submarine cables, the one uniting Saigon and Hue to Amoy on the Chinese coast, and thence to the Russian lines through Manchuria and Siberia; the other connecting Oran with Tangier; and insists upon their importance because they help to break down "the terrible British submarine cable monopoly, which, in case of war, would have the effect of isolating us from our principal Colonies." This journal says that the Hue—Saigon—Amoy line has been cleverly and discreetly laid in four months, and it claims that it solves a grave problem, as it now offers an alternative route to the cables of the Eastern Telegraph Company, by which French diplomats in China and Japan can communicate with their Government in Paris. The Oran—Tangier cable, the journal claims, is equally of importance, because it places the French representative in Morocco and the Commander of the French Naval forces in the waters of Tangier in direct communication with Paris. Moreover, it is proposed to extend this cable to Senegal, when all the chief French Colonies, Madagascar excepted, will be directly coupled with the French capital without having to resort to the use of the British lines.

New Telegraph Instrument.—The authorities at the General Post Office have recently been conducting experiments with a new telegraph instrument, the invention of M. Mercadier. For the present these experiments have been dropped, but will probably be resumed. No information as to the value of the new invention is yet forthcoming, but it has not thus far been used in France. As described to a representative of the *Daily Chronicle* by one of the Post Office officials, the Morse code is used in connection with the instrument, which requires 24 operators at each end of the wire, and the inventor claims that it will be possible to transmit 12 messages from each end at the same time. The operator who receives the messages will read them by sound, by means of an arrangement fitted to his ears. The inventor maintains that one line will suffice, and that his system can be more economically worked than any other at present in existence.

Pacific Cable.—Reuter's agent at Ottawa says that the Canadian Government has determined to hold the Pacific Cable Bill until it has been decided whether the arrangement of New South Wales with the Eastern Extension Telegraph Company is detrimental to the British Pacific Cable interest.

The *Times* Ottawa correspondent says that the Pacific Cable Bill has passed the Senate with the reservation made by the House of Commons. Mr. Scott, referring to the New South Wales agreement with the Eastern Extension Company, remarked that he would not say that Canada had been betrayed, but it was evident that the compact entered into by the colonies at Ottawa in 1894 had not been faithfully carried out.

Portsmouth Telephones.—At the meeting of the T.C. last week, the Telephone Committee reported that having prepared specifications, and advertised for tenders to establish a 1,200-line municipal telephone exchange, in accordance with Mr. Bennett's report, they found that the total cost of carrying out the work would amount to £25,325 13s. 2d., that being within the amount mentioned in Mr. Bennett's estimate. The Committee therefore recommended that application be made to borrow £26,000 for the purpose of carrying it out. The Committee added that the tenders received, and which would be recommended, amounted to £18,996 13s. 2d. Those were for the work to be executed, and there were also various expenses, such as engineers' fees, salaries of manager and inspectors during construction, printing and stationery, tools and testing instruments, and some other items, amounting to £4,329, and the sum of £2,000 which had been put down for contingencies, making in all £6,329. This sum, added to the total of the tenders, made up a sum of £25,325 13s. 2d., which had been given as the cost of carrying out the whole scheme. The report was adopted. It was stated that the Committee had arranged for the telephone wires to be laid beneath the tramway track during reconstruction, thereby obviating a lot of obstructive and costly work in the near future.

Swansea Telephones.—The T.C. has resolved to appoint a committee to consider the question of municipal telephones.

Telegraphic Interruptions and Repairs :—

Cables.	Interrupted.	Repaired.
Latakia-Cyprus	.. June 20, 1899 ..	..
Para-Maranham	.. March 1, 1900 ..	..
Landlines :—		
Siberian—Blagowestschensk-Chabarowsk	.. May 15, 1901 ..	May 17
Chinese cables—Chifu-Shanghai ..	.. May 12, 1901 ..	May 18
Bolama-Bissao	.. May 19, 1901 ..	..
Cayenne-Pinheiro	.. April 20, 1901 ..	..

Telegraphists and Postmaster-General.—On Friday, May 17th, the Secretary of the London Branch Postal Telegraph Clerks' Association addressed a letter to Sir George Murray, the Secretary of the General Post Office, on the question of the right of operators to rise to a maximum of £190. The letter was a portion of a correspondence that began on May 7th. On that date a letter was sent to Lord Londonderry, expressing the pleasure of the London telegraphists at the willingness of the Postmaster-General to reopen discussion on the question, and asking him to receive a deputation in order that evidence might be given to establish the charge of "breach of faith." On May 10th Sir George Murray asked to be supplied with some further particulars, and on May 17th these details were supplied. The last communication sets forth that a promise was given to clerks entering between 1881 and 1890 of a "prospect of attaining £190" as operators, and that that promise has now been withdrawn. The letter continues :—

> The removal of the promise of "a prospect of attaining £190" from the notice to candidates, and the replacement of it by the present notice promising only £160, is in itself an admission that the first promise was an undertaking which the Department were no longer prepared to carry out.

After an exhaustive examination of the evidence, which has already appeared in the Electrical Review, the letter thus concludes :—

> The "breach of faith" consists in the alteration of the duties and designation of the senior class in such a way as to wrest it from its original and proper position as part of the operators' scale, and thus remove it from the scope of the recommendation of the Tweedmouth Committee on Classification. This, combined with the breakdown of the classification system, has made it impossible for men who entered with a promise of attaining £190 as telegraphists—a promise accepted in good faith—to obtain such a salary. Take my own case as an example. Last year 13 men were promoted to the senior class; there are 353 men awaiting promotion, and I am at least 100 further behind. I have nearly 20 years' service, and at the rate of 13 per annum it will take about 35 years to reach my turn for promotion, and a further four years to attain £190. By that time I should have 59 years' service, and be 74 years of age, or far beyond pensionable age. Even assuming the progress to be considerably accelerated by other factors not now operating, it can hardly be supposed that I shall reach £190 a year before retirement. What, then, becomes of the promised prospect of attaining £190? For those behind me the outlook is worse.
>
> The alteration we suggest is the application of the Tweedmouth Committee's recommendation to the barrier at £160. Ample evidence, documentary and verbal, can be adduced in support of our contention. The gradual conversion of the senior class into a supervising class in duty and in name we consider as an act of injustice which removed it from the operation of the Tweedmouth Committee's recommendation. In 1881 and for some years subsequently telegraphists could, and did, attain £190 after 21 to 23 years' service. Despite the increase in the cost of living and the general upward tendency of wages this prospect has gradually receded until now we have practically no hope of attaining the maximum salary held out to us as an inducement to enter the service.

The negotiations are being followed with great interest by all postal employés, and it is hoped that Lord Londonderry will at least consent to receive the deputation. A charge of "breach of faith" should be disposed of without delay.

The Telephone Systems of the Australian States.—Mr. J. G. Drake, Federal Postmaster-General, recently informed the Deputy Postmaster-General of Victoria that one of the first tasks he will undertake will be that of placing the telephone systems of the various States on a uniform basis.

Wireless Telegraphy.—The Marconi International Communication Company has just opened a station at Caister-on-Sea, a small village two miles to the north of Great Yarmouth. It will be possible to transmit messages to ships within a radius of 60 miles. The *Morning Post* states that the Admiralty have informed the Devonport Dockyard authorities that the battleships and cruisers in commission for the home stations, and all vessels being prepared for the Reserve, Training, and Channel Squadrons are to be fitted with wireless telegraphy apparatus. All battleships and cruisers sent to the Mediterranean are in future to be similarly equipped. The Admiralty have adopted the "Apps-Newton" coils as the standard pattern, and have placed a large order with Messrs. Newton & Co., of Fleet Street, for coils and transmitters.

CONTRACTS OPEN AND CLOSED.

OPEN

Brazil.—July 8th. The Foreign Secretary has received a despatch from H.M. Consul-General at Rio de Janeiro, stating that tenders are invited by the Brazilian Government, to be received not later than July 8th, for the supply of electrical machinery for the hoisting and transporting of locomotives at the Engenho de Dentro Works Some particulars may be examined at the Commercial Department of the Foreign Office.

Dundee.—May 30th. The Gas Commissioners want tenders for steam piping, &c., for the electricity works. See "Official Notices" May 10th.

Dublin.—June 3rd. The Lighting Committee wants tenders for main and sub-station switchboards, transformers, arc lamps and pillars. See "Official Notices" April 26th.

Dublin.—June 3rd. The Lighting Committee wants tenders for switchboards, transformers, arc lamps and posts. See "Official Notices" May 10th.

Dublin.—June 3rd. The Lighting Committee wants tenders for motors and motor-generators, battery, meters, and wiring the works. See "Official Notices" May 17th.

Dundee.—June 5th. The T.C. wants tenders for the overhead equipment of the Seagate route. See "Official Notices" to-day.

Eastbourne.—June 7th. The Corporation wants tenders for 400 alternating meters, also 200-volt lamps. See two "Official Notices" to-day.

Eastbourne.—June 8th. The Corporation wants tenders for economiser, feed heater, piping, tank, and crane. See "Official Notices" to-day.

Edinburgh.—June 12th. The Council wants tenders for electric lighting installation at the Colinton Mains Fever Hospital. See "Official Notices" May 17th.

Edinburgh.—June 15th. The Corporation wants tenders for ash conveying plant for Dewar Place station. See "Official Notices" to-day.

Exeter.—June 14th. The Council wants tenders for water-tube boilers, steam alternators, switchboards, coaling apparatus, tanks, &c. See "Official Notices" May 10th.

Farnworth.—June 7th. The U.D.C. wants tenders for the overhead equipment of five miles of tramways, and tramway poles. See "Official Notices" to-day.

France.—June 10th. The municipal authorities of Ardres (Pas de Calais) are inviting tenders until June 10th for the concession for the electric lighting of the town. Particulars may be obtained from, and tenders are to be sent to, La Mairie d'Ardres (Pas de Calais).

Glasgow.—June 10th. The Corporation wants tenders for branch rubber-covered cables. See "Official Notices" to-day.

Glasgow.—June 10th. The Corporation wants tenders for electricity meters. See "Official Notices" May 17th.

Hendon.—June 5th. The U.D.C. wants tenders for the wiring of the new Council offices. See "Official Notices" May 3rd.

Ipswich.—June 8th. The Corporation wants tenders for dryback marine type boilers 11 ft. 6 in. × 14 ft. long. See "Official Notices" May 17th.

Islington.—June 11th. The Lighting Committee wants offers for "free" or "assisted" wiring; also for painting arc lamp columns. See "Official Notices" to-day.

Kingstown.—May 30th. The U.D.C. wants tenders for boilers, pumps, piping, economiser, &c.; engines, generators, balancer, and booster; switchboards and instruments; battery; cables, street work, boxes, switch pillars; electric wiring of supply station; electricity meters, demand indicators, and main fuses; arc and incandescent lamps, &c. See "Official Notices" May 10th.

London.—June 12th. The Central Electric Supply Company wants tenders for three 20-ton and one 10-ton travelling cranes. See "Official Notices" to-day.

London.—June 12th. The East Indian Railway Company is in the market for electric overhead travelling cranes. Specification to be seen at the company's offices. Tenders to Mr. C. W. Young, Secretary, Nicholas Lane, London, E.C.

Madrid.—June 1st. The Secretary of State for Foreign Affairs has received a despatch from H.M. Ambassador at Madrid stating that tenders are invited by the Spanish Postal and Telegraph Department for the supply of 30,000 zinc cylinders for the service of the Government telegraph stations. Such particulars as have been received may be examined at the Commercial Department of the Foreign Office.

Maidstone.—May 30th. The E.L. Committee wants free wiring proposals. See "Official Notices" May 17th.

Manchester.—May 25th. The Tramways Committee wants tenders for track work, cross-over tracks, &c. See "Official Notices" May 17th.

Manchester.—June 4th. The Tramways Committee wants tenders for electrical fittings for lighting the Queen's Road car shed. See "Official Notices" to-day.

Poplar.—June 4th. The Electricity Committee wants tenders for a storage battery. See "Official Notices" to-day.

Rochdale.—June 7th. The Corporation wants tenders for six specimen electric tramcars. See "Official Notices" to-day.

Sunderland.—May 31st. The Corporation wants tenders for coal bunker and overhead gantry for electricity works. See "Official Notices" May 17th.

Taunton.—June 11th. The Corporation wants tenders for one 250-kw. steam alternator, one 15-kw. motor-generator, switchboard extensions, water-tube boiler superheater, condensing plant, piping, &c. See "Official Notices" to-day.

Tonbridge.—May 30th. The U.D.C. wants tenders for Lancashire boilers, two 50-kw. steam dynamos, condensing plant, crane, switchboard, battery, mains, arc and incandescent lighting, house meters, &c. See "Official Notices" April 12th.

Warrington.—June 13th. The Corporation invites tenders for boiler, 500-kw. engine (Willans) and dynamo, and mains, &c. See "Official Notices" to-day.

Worksop.—May 29th. The U.D.C. wants tenders for the supply of 150 electricity meters. See "Official Notices" May 17th.

CLOSED.

Barrow.—The Corporation has contracted with Messrs. Mavor & Coulson for balancing transformer and switchboard work, the B.I.W. Co. for cables, Doulton & Co. and the Albion Clay Co. for conduits.

Brighton.—The T.C. received the following tenders for the constructional steel work for the new generating station at Portslade :—

Redpath Brown & Co., Edinburgh	£15,978 0 0
E. C. & J. Keay, Ltd., Birmingham	16,805 0 0
Cross & Cross, Walsall	16,661 0 0
J. Westwood & Co., Millwall	16,690 0 0
Flemmingways, Ltd., Middlesboro'	17,000 0 0
Dorman, Long & Co., Middlesboro'	17,280 0 0
F. Demolder, Brussels	17,950 0 0
W. James & Sons, Bow	18,000 0 0
J. Butler & Co., Leeds	18,357 2 2
Head, Wrightson & Co., Middlesboro'	18,388 10 0
J. Lysaght, Ltd., Bristol	18,500 0 0
Heenan & Froude, Manchester	18,500 0 0
Phœnix Foundry Company, Derby	18,563 10 0
A. Findlay & Co., Motherwell	18,600 0 0
Sir W. Arrol & Co., Glasgow	19,200 0 0
M. T. Shaw & Co., London	19,354 0 0
W. A. Baker & Co., Newport	19,600 0 0
Peirson & Co., London	19,700 0 0
Somervail & Co., Glasgow	19,999 7 10
Newton, Chambers & Co., Sheffield	20,053 0 0
Horsley & Co., Tipton	20,087 12 0
Cleveland Bridge and Engineering Co., Darlington	20,122 0 0
R. Dempster & Sons, Elland	20,583 18 4
Mechan & Sons, Glasgow	21,440 0 0
Westwood & Wrights, Brierley Hill	21,570 0 0
American Bridge Co., United States	23,000 0 0
Chas. Wall, Gray's, Essex	23,000 0 0
E. Wood & Co., Manchester	23,000 0 0
Goddard Massey & Warner, Ltd., Nottingham	25,000 18 5
J. Shewell & Co., Darlington	25,599 3 9
Pedrette & Co., London	26,700 0 0
Dean, Ransomes & Co., London	27,000 0 0
Thames Iron Works Co., London	28,173 0 0
Arrol's Bridge and Roof Co., Glasgow	28,580 0 0
Maguire & Baucus, London	28,974 0 0
Archibld Downay & Sons, Ltd., London Bridge	29,255 18 0
E. Danks & Co., Oldbury	52,500 0 0

The T.C., on the recommendation of Mr. Arthur Wright, the consulting engineer, accepted the tender of Messrs. Redpath, Brown & Co., Ltd., at £15,978.

Burnley.—A contract for a couple of Lancashire boilers and economisers, for the electricity works, has been given to the Oldham Boiler Works Company, Limited.

Dublin.—The T.C. has accepted the tender of Messrs. J. Spencer, Limited, Wednesbury, for the supply of intake-piping, wells, valves, &c., for the Pigeon House station, at a cost of £1,043.

Farnworth.—The Electricity Committee has accepted the tender of the British Insulated Wire Company, for the lighting of the main streets by arc lamps, to the specification of the consulting engineers, Messrs. Lacey, Clirehugh & Sillar.

Greece.—A contract to convert the railway between the Piræus and Athens into an electric line has been secured by La Compagnie Hellenique d'Electricité (Système Thomson-Houston).

London.—The Shoreditch Borough Council, at its meeting on Tuesday, considered the following tenders for the supply of low and high tension lead-covered cables required during the next nine months for extensions of the service :—

Henley's Telegraph Works Company (accepted)	£10,516
British Insulated Wire Company	10,619
W. T. Glover & Co.	10,766
Siemens Bros.	11,565

The tender of the Renewable Lamp Company was also accepted for the supply of incandescent lamps during the year, the lamps to be renewed at any time at from 7d. to 9d. each.

Middlesbro'.—The E.L. Committee's recommendation to accept the tender of Witting Bros., referred to last week, came before the T.C. last week and was passed after several amendments relating to foreign competition had been disposed of. The Electrical Trades Union had previously lodged a protest with the Mayor. One amendment proposing to give the contract to Messrs. Mavor & Coulson was lost by 11 votes in favour and 13 against.

Shanghai.—The Municipal Council recently discussed the tenders for the new electrical plant and accepted that of Messrs. Fearon, Daniel & Co., for the Aultmann & Taylor Manufacturing Co., to cost £810 c.i.f., the members being to some extent influenced in their decision by the satisfaction given by the boiler purchased two years ago from these manufacturers.

Sydney (N.S.W.).—The tender of the British Insulated Wire Company, Limited, has been accepted by the Railway Commissioners for the supply, delivery, and laying of 29 miles of high-tension and two miles of low-tension cables. The price for carrying out the works in terms of the Commissioners' specifications is £38,594. These cables will be required in connection with the extension of the electric tramway system.

Woolwich.—The Borough Council have accepted the tender of Messrs. Smith & Son, of South Norwood, of £40,574, for buildings in connection with electricity works and dust destructor.

FORTHCOMING EVENTS.

Friday, May 24th.—At 9 p.m. Royal Institution. Lecture on "The Aims of the National Physical Laboratory," by R. T. Glazebrook.

Thursday, May 30th.—At 8 p.m. Institution of Electrical Engineers. Annual general meeting at the Society of Arts, John Street, Adelphi, W.C., to receive annual report of Council and statement of accounts and balance sheet for 12 months ending December, 1900. The announcement of the election of the new Council will be made at this meeting.

At 3 p.m. Royal Institution. Prof. Dewar, F.R.S., will deliver his second lecture on "The Chemistry of Carbon."

Friday, May 31st.—At 5 p.m. Physical Society. Meeting at the rooms of the Chemical Society, Burlington House. Agenda:—(1) "On a Model which imitates the behaviour of Dielectrics," by Prof. Fleming, F.R.S., and Mr. A. W. Ashton, B.Sc. (2) "On the Resistance of Dielectrics and the Effect of an Alternating Electromotive Force on the Insulating Properties of India-rubber," by Mr. Ashton. (3) "Note on the Electrification of Dielectrics by Mechanical Means," by Mr. Ashton.

NOTES.

Correction.—In our note on the Castner-Kellner patent case judgment last week, by a clerical error we used the word "plaintiffs" instead of "defendants." The full report of the judgment as given, in favour of the Castner-Kellner Company, is published this week.

Summer Meeting of the American Institute of Electrical Engineers.—The preliminary programme of arrangements in connection with the above is as follows :—

It is proposed to begin the programme by a meeting of the members of the American Institute of Electrical Engineers and their European guests for formal welcome and reception on Wednesday, August 14th, 1901, at the house of one of the engineering societies in New York City, as found most convenient, and as arranged later. A collation will be served after the meeting, and there will be a steamboat excursion in the afternoon. On the two following days technical visits will be made to important works and installations in the city and vicinity. A banquet will take place on one of these evenings, and arrangements may be made later for reception or entertainment on the other evening. No special assignment is made for Saturday, to enable visitors to make their own arrangements for sight-seeing and recreation. The Council Committee has under consideration for Sunday, August 18th, a daylight trip up the Hudson (the American Rhine), to some convenient point, thence by rail to Albany, where the party will stop over night, leaving early on Monday, August 19th, for a visit to the works of the General Electric Company at Schenectady. From Schenectady the party will go by special train to Buffalo. On Tuesday morning, August 20th, the general meeting will open at Buffalo, in the Temple of Music, with addresses by the Exposition and municipal officials. A preliminary visit will be made to the Exposition in the afternoon. On the three following days there will be sessions for the reading and discussion of papers in the forenoons, and perhaps on some of the afternoons. It is expected that the Exposition officials will designate one of these days as "Electrical Day." The programme contemplates the allotment of an entire day, if possible, for an excursion to Niagara Falls and the various electrical features to be seen at that place. Visits will also be made to various sub-stations in Buffalo. The closing meeting will probably be held on Saturday, August 24th.

The above note will be of interest to any electrical engineers in this country who contemplate allowing themselves the pleasure of a visit to the States on this occasion, and availing themselves of the kind hospitality of their American confrères.

Obituary.—E. W. Parsoné.—We regret to record the death, in his 53rd year, of Mr. E. W. Parsoné, who for the last 30 years has been intimately connected with the submarine telegraph industry. Mr. Parsoné, on leaving the University College School, entered the service of the Great Western Railway Company, and in 1870 joined the staff of the late Sir Charles Bright, and was employed in the laying of the cables of the West India and Panama Telegraph Company. He was eventually engaged on the staff of the India-Rubber, Gutta-Percha and Telegraph Works Company, and after being employed in the laying of cables along the French coast, and between Marseilles and Algeria, and between Marseilles and Barcelona, he proceeded to the west coast of South America and became manager of the first series of submarine cables laid in these waters between Callao, in Peru, and Valparaiso, in Chili. He served with conspicuous ability in this post during the trying times of the war between these two countries, and made many friends among the native and foreign merchants, which friendships have endured until death has carried him away. In the cable steamer *Retriever*, Mr. Parsoné surveyed the route for the laying of the cables which connect Salina Cruz, in Mexico, with Callao, in Peru, and are the property of the Central and South American Telegraph Company. Returning to England in 1884, Mr. Parsoné was appointed manager of the West African Telegraph Company, and organised the service on the string of cables connecting the Cape de Verde Islands and the principal settlements on the West Coast of Africa. While on the Congo river he visited Shark Point, and reported to the Royal Geographical Society the locality of one of Diego Cam's beacons, the existence of which was suspected, but was unknown to modern geographers. After remaining a few years on the West Coast of Africa, Mr. Parsoné came home, and shortly afterwards proceeded to Brazil in connection with the South American Cable Company, of which he was manager and secretary at his death. The deceased had qualifications in connection with submarine telegraphs which are rare among the younger men now that the growth of this great necessity to modern life has called for sub-division of work and specialisation. He knew the business in its electrical, mechanical and commercial bearings, and was consequently never at a loss in whatever circumstances he found himself. From the personal point of view, his friends have lost a cheery companion, full of humour and goodwill towards his fellow men. The French Government had conferred on him the decoration of Officier de l'Instruction Publique, and the Government of Portugal had granted him a Knight Commandership of the Order of Christ. Mr. Parsoné joined the Institution of Electrical Engineers in 1874, and for the last twenty years has been a full member. He was also a Fellow of the Royal Geographical Societies of London and Lisbon. The funeral took place at 3 o'clock p.m. yesterday, May 23rd, at Lee Cemetery.

Sir Courtenay Boyle.—It is with feelings of profound regret that we announce that Sir Courtenay Boyle, K.C.B., passed away on Sunday last, the cause of death being failure of the heart's action. During his occupation of the important office of permanent secretary to the Board of Trade, Sir Courtenay Boyle came into touch with the leaders of all the great trades and industries of the United Kingdom, and seems to have been singularly well equipped for the great work which fell upon his shoulders. He spared no effort to arrive at a full appreciation of the myriad matters which came under his view, and his great industry and the indefatigable manner in which he applied himself to his very wide duties may, it is thought, have had a good deal to do with the apparently undue termination to his career at the comparatively early age of 56 years. Those whose privilege it has been to appear before him in regard to questions affecting the interests of electric lighting and tramway industries of this kingdom, will remember his business-like manner of dealing with such matters. Whatever evidence was brought before him in connection with the formulation of electric lighting and traction rules and regulations, or in relation to electrical communication between lightships and the shore, was always sure to receive its due attention. Sir Courtenay has in his time left a very distinct mark upon the public electrical engineering undertakings in England. In electrical matters he was an accomplished legislator, and a skilled diplomatist of a very high order. However highly qualified may be his successor he can hardly possess a clearer understanding of the position of our electrical industries, and Sir Courtenay must be very sadly missed at future electrical conferences at the Board of Trade. But his electrical side seems to have been but a small—a very small—part of the man himself. With matters affecting our railways, canals, shipping, patents, gas and water supply, commercial education and business capacity, bankruptcies, liquidation and so on, he was equally well conversant, and electrical engineers will form but a small section of the great community which will mourn his loss. We may add that from 1886 to 1893 he was assistant secretary in the Railway Department, and in 1893 he became permanent secretary of the Board of Trade. His mortal remains were laid to rest at Hampton Church yesterday afternoon.

Electric Lifts at Greenwich Tunnel.—The report of the Bridges Committee of the L.C.C. referred to the expediency of providing lifts for the convenience of the public at the access shafts of the Greenwich footway tunnel, and submitted details of three schemes which had been under consideration. The second scheme proposes the installation of a single lift in each shaft at an initial outlay of £6,000 for the two shafts, including motors, overhead gear and housing. As the lifts would be in operation about 16 hours per day, it was estimated that the cost of electrical energy to work them would amount to £350 per annum, and the committee recommended the Council to approve an estimate of £6,000 for single lifts, and to authorise the issue of advertisements inviting tenders for the execution of the work. The recommendation was adopted.

Wages of Wiremen.—The Finance Committee of the L.C.C. reported at Tuesday's meeting that the Electrical Trades Union had drawn their attention to the fact that the rate of wages for wiremen in the Council's list, amounting to from 8½d. to 9½d. per hour, was not that obtained in practice, and the union had asked that the rate might be increased to 9½d. per hour. After careful inquiry, the committee had come to the conclusion that the list should be so amended, and they recommended the Council to increase the rate to 9½d. per hour. This was agreed to without discussion.

Personal.—We read in *South Africa* that when Mr. C. B. Elliott, the general manager of the Cape Government Railways, was last over here, he made very close inquiries into the subject of motor transport, electrical locomotion, and light railways. It is understood that he will return to this country, as Special Railway Commissioner, to inquire more fully into all the improvements recently introduced.

Last week we stated that the Companionship of the Order of Danneborg, had been conferred upon Mr. Hibberdine and Mr. Hesse. We hasten to correct an error, for these two gentlemen have been made Knights of the Order mentioned, and not Companions. Mr. Hesse is not secretary of the Eastern Telegraph Company, but manager and secretary of the Eastern Extension, Australasia and China Telegraph Company.

Mr. J. H. Rider, the recently appointed chief electrical engineer to the London County Council, has been engaged for some time on a treatise on electric traction which he is writing for Messrs. Whittaker & Co. It is to be published in the autumn, and will treat very fully of the different systems of electric tramways.

Out of 104 applicants, the Sutton Coldfield Town Council has appointed Mr. Trevor Duesbury (chief assistant engineer at the City of Gloucester Electricity Works), resident electrical engineer, at a salary of £200 per annum.

With reference to our note last week, we are requested to state that Mr. Philip Dawson is not the editor of *Traction and Transmission*. We gave the note on the authority of an American contemporary.

The Southport Electricity Committee has promoted Mr. A. S. Black from the position of mains superintendent to that of chief assistant electrical engineer. Mr. R. Wheeler has been appointed his successor as mains superintendent.

Carroll v. the New British Incandescent Electric Lamp Company.—In the Chancery Division of the High Court of Justice on Wednesday (May 22nd) Mr. Justice Byrne in this debenture holders' action had before him a motion for judgment which came on in default of appearance by the company. The company was founded in 1898 with a capital of £30,000, and it issued debentures for £7,950, of which the plaintiff was the holder of £2,000. The debentures were a charge on all the property of the company, and the plaintiff's moneys had become payable. It was stated that a distress for rent had been put in, and that an order for the appointment of a receiver had been made by Mr. Justice Buckley. Mr. Justice Byrne made an order in the common form.

National Electrical Contractors' Association.—Mr. Thos. Guthrie, Convener of the Provisional Committee, asks us to announce that a meeting is to be held in his office, 46, Queen Victoria Street, E.C., on Tuesday the 28th inst., at 2 o'clock p.m., for the purpose of forming the National Electrical Contractors' Association, already referred to in our columns. The attendance of members of electrical contractors' associations already formed, and of electrical contractors disposed to identify themselves with the movement, is heartily desired.

Business Announcement.—The business of Fuller and Co., of Red Lion Court, E.C., will in future be carried on under the style of Fuller, Macleod & Co., Limited. Mr. A. W. Macleod, for many years with John Fowler & Co. (Leeds), Limited, is managing director. The business of the Fuller-Wenström Electrical Manufacturing Company, which has hitherto been carried on at the same address, will in future be conducted at 110, Cannon Street, E.C., under the personal supervision of Mr. J. L. Fuller. These alterations have been made with a view to enlarging the scope of the business.

The Institution Museum.—The secretary of the Institution of Electrical Engineers is circularising the members with a view to furthering the scheme for establishing a museum of electrical objects or apparatus not now in commercial use, but possessing interest in connection with electrical science and its application. The idea is very praiseworthy, and those able to assist in its fulfilment should write to Mr. McMillan at 28, Victoria Street, S.W., for the necessary forms to fill up.

The Glasgow Tramways.—In a "Traction Note" last week we mentioned that the sales of tramway horses at Glasgow are not to be proceeded with at present. We understand the reason of this action on the part of the Tramways Committee is that the only engines in the new tramway station which have been on load since the commencement of the service are the two 1,000-H.P. Stewart auxiliary engines. The two 4,000-H.P. Allis engines, we are informed, have not so far had a successful run owing to the bearings not yet being sufficiently adjusted to allow them to run cool; the two Musgrave engines of equal power are not expected to be erected complete and ready for work for two months yet. It is stated that the Allis engines will be on the load very shortly, and then the sale of horses may be resumed as more electric cars are brought into service.

Institution of Mechanical Engineers.—The annual conversazione of the Institution of Mechanical Engineers, which marks the close of the session, took place on 17th inst. at Storey's Gate, Westminster. Mr. W. H. Maw, the president, and Mrs. Maw received the guests, who numbered 800, in the large hall.

Newport Electric Lighting.—The Mayor has been asked to convene a meeting of ratepayers to consider the question of the expense of electric lighting.

Appointments Vacant.—The Gloucester Corporation wants a chief assistant engineer. A mains engineer is wanted by the Reading Electric Supply Company.

Marriage.—On April 17th, Mr. G. F. Ratcliff, of the firm of G. F. Ratcliff & Co., electrical engineers, Oxford Street, was married to Miss Georgina Campbell, daughter of Major-General Campbell, of Ramsgate.

To Standardise Electric Traction Equipment.—A Committee on Standardisation of Street Railway Equipment was recently appointed by the executive of the American Street Railway Association. A comprehensive report is preparing for submission at the October annual meeting. The Committee is visiting leading manufacturers ascertaining their views on this very important matter.

Institution of Electrical Engineers' Visit to Germany.—We understand that the preliminary arrangements for the Institution visit are now almost complete, and that the date of departure—namely, Saturday evening, June 22nd—remains unchanged. The circulars giving the completed programme will, we are informed, be issued immediately after Whitsuntide.

Electricity in British Steel Works.—We are informed that Messrs. Ernest Scott & Mountain, Limited, of Newcastle-on-Tyne, have secured an important contract in South Wales for the Port Talbot Iron and Steel Company, in connection with the new steel rolling mills which that firm are erecting. As this mill will be one of the most modern in this country, and probably the first new mill in which a complete equipment of electrically-driven machinery has been adopted, a short description of the plant may be of interest. The installation consists of a compound horizontal engine capable of developing 600 H.P. with a steam pressure of 150 lbs. per square inch, driving a pair of Scott and Mountain's generators, each generator being capable of giving an output of 200 KW., or collectively 400 KW., equal to 540 E.H.P. at the terminals. The current is utilised for working a 60-ton crane for the casting pit, this crane being fitted with four electric motors, *i.e.*, one motor for heavy lifts, one motor for low lifts and for tilting the ladle, one motor for longitudinal traverse, and one motor for cross traverse. Over the casting pit a 10-ton crane of the three-motor electric type is being fitted, dealing with the ingots and bringing them to the rolling mills. A 25-ton crane is placed in the rolling mill, and is utilised for changing the rolls and also for taking the rolls to the roll-turning and mechanics' shop, which is placed at the end of the mill, so that the rolls can be lifted out of the housings and dropped straight into the roll-turning lathes. A 5-ton crane placed over the stock bank is also of the three-motor type, and is arranged for very quick speeds, so that the finished material can be handled and stocked very expeditiously. The live rollers in the rolling mills are controlled by independent motors, and so is the screwing-down gear for adjusting the rolls. These motors will be operated from a platform by one man, who will have control of the cogging mill and also of the finishing mill. The skidding gear is also driven by electric motors, so that practically the ingots, after being cast, are dealt with, up to the time of their leaving the rolling mill, purely by electrical gear. The finished work, after it leaves the rolling mill, is taken by live rollers to the circular saws, which are driven by electric motors, the cold saws and straightening machines being also driven in the same manner, and a further set of skidding gear, electrically-driven, is provided on the stock bank, so that the goods can be expeditiously loaded and stored. The works are to be lighted throughout by arc and incandescent lamps, driven by a Scott & Mountain independent generator.

NEW COMPANIES REGISTERED.

A. Reyrolle & Co., Limited (70,210).—This company was registered on May 16th, with a capital of £20,000 in £1 shares, to acquire the business carried on at 20, Pancras Street, Tottenham Court Road, London, as "Reyrolle & Co.," to adopt an agreement with A. C. Reyrolle, and to carry on the business of electricians, electrical and mechanical engineers, manufacturers of electrical appliances, &c. The first subscribers (each with one share) are:—J. H. Armstrong, St. Nicholas Chambers, Newcastle-on-Tyne chartered accountant; A. C. Reyrolle, 20, Pancras Street, W.C.,

manufacturer; W. Negus, 36, Bloomsbury Square, W.C., solicitor; W. Merz, The Quarries, Newcastle-on-Tyne, accountant; J. R. W. Hulsen, 28, Sandhill, Newcastle-on-Tyne, merchant; G. B. Richardson, Neptune Works, Walker, Newcastle-on-Tyne, shipbuilder; and R. S. Watson, 141, Pilgrim Street, Newcastle-on-Tyne, solicitor. No initial public issue. The number of directors is not to be less than two nor more than five; the first are John H. Armstrong, Alphonse C. Reyrolle, William Negus, Arthur N. L. Wood and Arthur Scholefield; qualification, £300; remuneration, £120 per annum, divisible.

Fuller, Macleod & Co., Limited (70,197).—This company was registered on May 15th, with a capital of £10,000 in £1 shares. to acquire the business carried on at 9, Red Lion Court, E.C., by E. L. Fuller, as "Fuller & Co.," and to carry on the business of merchants, factors, dealers in electrical accessories and equipment, dynamos, motors, and the like, electrical engineers, makers of electrical and general engineering appliances, suppliers of light, heat and power, manufacterers of self-propelled and mechanically propelled vehicles, contractors, &c. The first subscribers are:—J. A. Ewing, 73, Basinghall Street, E.C., merchant, 100 shares; A. Kitchin, 9, Vincent Square, S.W., electrical engineer, 100 shares; A. W. Macleod, 6, Lombard Street, E.C., engineer, with 100 shares; W. A. Dinwiddie, Bridgebank House, Dumfries, N.B., manufacturer, with 100 shares; A. Tabor, 27, Clements Lane, E.C., solicitor, with one share; F. Elwell, 7, Martin's Lane, E.C., merchant, with one share; and F. V. Macleod, Dunskey, Parsifal Road, West Hampstead, N.W., merchant. Minimum cash subscription, 4,000 shares. The number of directors is not to be less than three nor more than five; the first are A. W. Macleod and J. A. Ewing.

Desolle Electro-Plating Company, Limited (70,162).—This company was registered on May 13th, with a capital of £70,000 in £1 shares, to acquire, under an agreement made by this company with A. Crerar, F. P. S. Harris, A. W. Sully, J. Melling, A. T. Rickards and J. M. Grant, certain patents of M. E. L. Desolle, of Fontenay Bois, France, relating to electro-plating, and to carry on the business of mechanical, electrical, sanitary and general engineers, metal founders, workers and converters, machinists, metallurgists, metal merchants, fitters, millwrights, boiler makers, wire drawers, tube makers, galvanisers, &c. The first subscribers (each with one share) are:—J. M. Grant, 63, Cornhill, E.C., merchant; A. T. Rickards, 40, Old Broad Street, E.C., solicitor; A. W. Sully, 19 and 21, Queen Victoria Street, E.C., chartered accountant; A. Crerar, 59, Wynnstay Gardens, Kensington, merchant; E. F. Norman, Rozel, Elm Road, Wemley, Middlesex, chartered accountant; H. A. Hill, 40, Old Broad Street, E.C., solicitor; J. H. Tweedale, 137, Elgin Road, Ilford, Essex, solicitor. Minimum cash subscription 20,000 shares. The number of directors is not to be less than three nor more than six; the first are J. M. Grant, G. C. Locket, W. R. Newburn, M. F. Rust, and R. Sanderson; qualification of first directors not specified; of subsequent directors, £500; remuneration, £100 per annum each, and £200 for the chairman, with a share in the profits.

CITY NOTES.

New General Traction Company.

Captain Francis Pavy presided at the fifth annual meeting, held at Cannon Street Hotel on Tuesday, and, in moving the adoption of the report, referred briefly to the position and prospects of the company. Their position was exceptionally good. They had not embarked in any doubtful operations, but had confined their operations in a small compass. This was the fifth year of the company's existence, and it was the first time that any distribution had been proposed on the ordinary shares, which was evidence of their careful and conservative policy. There was plenty of work to be done, but the difficulty experienced in coming to terms with municipal authorities who had axes to grind was very great. The speaker went on to refer to our backwardness in the matter of electric tramways in this country. The company had extremely able experts in the tramway business. They examined with great care the different schemes submitted to them—and such schemes had been numerous; but during the last year they only came across one or two which appeared worth following up. They were now considering new business, but in taking new business they must have a chance to live. They did not want to pledge the company to the risks involved without seeing their way to a fair profit. Rather than take business for the sake of doing it, he would prefer to hand the undertaking over to someone else. After going briefly over the expenses and receipts, the Chairman said that there was a total of £78,118 to the credit of the account. The preference dividend which was paid on May 15th amounted to £15,000, and deducting that from the total, there was a balance of £63,118, which they proposed to deal with by tranferring £7,000 to reserve against goodwill, and £10,000 to general reserve. The general reserve would then stand at £30,000, reserve against goodwill £20,000, and there would be a balance of £45,935. Deducting from that the 4 per cent. ordinary dividend (£4,800) left £41,835, which added to the two reserve items made practically £90,000 to credit in their accounts undivided; but that all came in on the principle that they were taking shares and securities in payment for the works they were carrying out at their par value. Although they had a very large surplus, they only commenced by paying 4 per cent. He hoped that a good many of those shares would be worth more than par; anyhow, he thought they were well within their rights in distributing 4 per cent. They were really only interested in about three or four undertakings. The Douglas tramways were a very small undertaking indeed, and for two years running they had received 6 per cent. on their preference shares. Norwich was the largest undertaking, and that had been at work now for about nine months. The year's accounts were not completed, but he had every reason to anticipate that their earnings would show 5 per cent. on their capital investment, therefore those shares could be put down at par value. They had an investment in Coventry, but the town had been having a bad time, and the people had not had much money to spare for tramway travelling. The company was, however, receiving a dividend and the traffics were improving, and that would go on. At Philadelphia they had 20 miles of tramway in the outskirts running into the main tramway system. Everybody spoke favourably of that enterprise. That would, perhaps, prove to be their most valuable asset. Nine miles were completed and running, and they were giving about the same results as at Norwich, working under the disadvantage of disconnected lines. He was looking to the future of the company with great hope. He and his friends owned nearly the whole of the capital, and they had had under consideration what to do with regard to fresh issues of capital. He had deprecated further issues of 6 per cent. preference shares if they could be avoided. They had gone on to complete their works by putting their hands into their own pockets and finding the money, and there was, therefore, £57,000 secured loans. They had now come to the conclusion that it would be best for them to issue £200,000 5 per cent. debentures. They would have special securities. They would hypothecate Norwich, Coventry, and other shares to them. If the public did not care to take them up, they themselves would do so.

The adoption of the report was seconded by the Hon. A. G. Brand, M.P.

A lengthy discussion followed, in which the accounts were criticised for their "too-conciseness;" the item of £100,000 for goodwill was said to be out of all proportion to the size of the business; the question was asked whether the dividend was not a mere paper dividend as yet unrealised; the preference dividend was wanted paid half-yearly, instead of yearly. What was the value of the work done for the shares which were given in the balance-sheet? Was it not a fact that they were borrowing money to pay the dividends? What was the cost of the different tramways? These, and sundry other questions, were replied to by the chairman and auditor to the satisfaction of shareholders. The board deemed it undesirable to give away the figures as to the cost of work. They had been approached to sell their undertaking, but the terms were not acceptable. The Norwich shares were saleable at par to-day, but they thought they could do better for the company by holding them for a time. The profits were, of course, paper profits, because the works were not yet all closed. They had to borrow to pay dividends on the shares.

The resolution was then carried unanimously, as was also the motion declaring 4 per cent. on the ordinary shares, and the resolutions re-electing directors and auditors.

Callender's Cable and Construction Company.

The annual general meeting was held on 16th inst. at Hamilton House, Victoria Embankment.

Mr. Henry Drake, in moving the adoption of the report, said that the company had had a very successful year. The preference share capital had been doubled, and now stood at £200,000, as compared with £100,000 a year ago. Bills payable on December 31st last figured for £111,000, as compared with £142,000 a year previously, and trade creditors were represented by £65,900, against £80,000. From the *Times* report we learn that he said that these figures showed a very healthy state of things considering the much larger business done by the company. "On the other side of the balance-sheet it would be seen that during 1900 nearly £21,000 was expended on the enlargement of the works, additional plant, &c. This was an item which could not be helped, as they must keep pace with the times and be prepared to do all the work for which orders could be obtained. He thought there would be a further outlay this year. After allowing for what had been written off for depreciation the total amount of this item stood at £197,000, against £183,000 a year previously, or a net increase of only about £13,000 or £14,000, which was not large considering the figures they were dealing with. The expenditure on contracts in course of execution stood at £107,000, showing an increase of nearly £40,000; while sundry debtors figured at £285,000, which was about £5,000 less than a year ago. The cash and bills receivable exhibited an increase of about £40,000. They held £9,629 in shares in other companies, as against £7,500 a year ago. The directors endeavoured to keep this item down, but in order to obtain valuable contracts the company must hold a few shares in some companies. The profit on the manufacturing account last year was nearly £101,000, as compared with £64,000 in the previous year, and the balance carried down was £70,546, or an increase of £28,000. After paying interest on debentures, and the dividend on the preference shares, and making the different appropriations shown, there was an available balance of £56,972, including the amount brought forward (£8,211). They proposed the same dividend as was paid last year (10 per cent.) and the same bonus (5s. a share), making together 15 per cent., and to increase the reserve fund to £100,000 by placing £23,616 to it. There would then remain £10,855 to be carried forward. It might appear, perhaps, to some of the shareholders that the amount carried to reserve was large, but, in view of the extensive business which the company were doing, he thought that they would agree that the directors ought to be careful. It must also be remembered that as time went on competition became very keen, and the tendency was

to make the prices closer. The prospects of the company for the present year were excellent.

Major W. M. Mackenzie seconded the motion, which was adopted.

Kidderminster and District Electric Light and Tramways Company.

The third ordinary general meeting of this company was held at Donington House last Friday. Mr. J. S. Raworth, who was in the chair, moved the adoption of the report published in our last issue, and in doing so said that the accounts were presented in Board of Trade form, a method which they would continue, as it saved the trouble of casting them into two separate forms, one for the Board of Trade and one for shareholders. Out of a capital of £59,966, £56,000 was invested in the tramways, and therefore there was only £3,996 of the company's own subscribed capital actually invested in the lighting business. However, by means of an overdraft from the bank and sundry debts, they had been able to spend £14,285 upon the lighting works. The sale of current registered by meter had been £182, but the time during which current was available was only three or four months at the latter end of the year, so that they had really scarcely commenced business, but with £18 derived from other sources and with the revenue from the tramway company of £1,540, they still had a balance of £1,186 to carry to net revenue. On the electric lighting account alone they had a loss of something over £300. That would be wiped out during the present year, and he hoped that they would have a very satisfactory balance to carry forward to next year. They proposed out of the available balance to pay £1,499 on the preference shares, and nothing on the ordinary, carrying forward a balance of £708. After referring briefly to the tramway capital account, the Chairman said that the state of their affairs looked fairly satisfactory. They were looking forward to the lighting and also to the supply of power to manufacturers, making a very considerable balance of profit to pay a fairly good dividend on the ordinary shares. In addition to that, they had promoted an order for a light railway from Kidderminster to Budeley. That order had been granted. They hoped to commence the construction of the line during the present year.

Mr. R. P. Sellon seconded the adoption of the report, which was carried.

The retiring directors and auditors having been re-elected, a special meeting was called to pass alterations in the articles to bring them into conformity with the new Companies' Act.

West India and Panama Telegraph Company.

The directors' report for the half-year ended December 31st, 1900, to be submitted to the meeting, held on May 23rd, 1901, reads as follows:—

The directors submit the accounts for the six months ended December 31st, 1900. The amount to credit of revenue is £24,900 0s. 1d., against £22,643 14s. 7d. for the corresponding half-year of 1899; the expenses have been £20,961 14s. 1d., against £21,432 13s. 8d., leaving a balance of £3,337 6s. The directors must again express their regret that owing to the very small and disappointing telegraphic business of the West Indies, which the reduced rates have so far failed to augment, the result of the half-year's working is so discouraging. To the small balance of £3,337 6s. there is added £2,379 19s. 5d. interest on investments, and £953 11s. 11d. brought over from the last account, making a total of only £6,670 17s. 4d. It will be seen that this sum is insufficient to meet the cumulative dividends on the first and second preference shares for the half-year, which amount to £11,769 12s. The Court of Appeal has given judgment against this company in the action brought against it by the Cuba Submarine Telegraph Company. At the time of writing this report the precise terms of the formal judgment have still to be settled. In these circumstances, and having regard to the fact that there is no longer any appreciable increase over cost in the value of the investments, the directors are of opinion that the most prudent course, in the interests of shareholders of all classes, is not to pay dividends from the reserve funds, as was done during the last two half-years, but to carry forward the balance of £6,670 17s. 4d. to the next account. Since the last general meeting, renewed efforts have been made to bring to the notice of the Colonial Secretary and the Colonies, the company's financial position and its urgent need of Imperial and Colonial assistance, but, thus far, without result. The directors are now considering what steps can be taken to increase the revenue of the company, as at present the prospects of an adequate improvement in West India telegraphic business are anything but hopeful. The company's second repairing steamer, *Duchess of Marlborough*, which has been lying up in London for a considerable period, has recently been sold. This will effect a small saving in future expenses. In accordance with the articles of association, Henry Holmes, Esq., retires at this meeting, and offers himself for re-election. The auditors, Messrs Deloitte, Dever, Griffiths and Co., also retire, and offer themselves for re-election.

Cork Electric Tramways and Lighting Company.

Mr. A. E. Lazarus presided at the meeting of this company held last Friday at 83, Cannon Street, E.C. The result of the year's working was that the receipts amounted to £32,856, and the working expenses to £21,488, leaving a balance of £11,000. Considerable progress had been made both in the traction and in lighting. The report for 1900 stated that the traffic receipts showed an increase of £1,774 and the receipts from lighting £4,178, compared with 1899. It was proposed to set aside £2,000 for depreciation of plant and machinery. In consequence of the increased demand, additional lighting cables, at a cost of about £18,000, had been laid in the city, and of sufficient capacity to meet all present requirements. The public arc lamps erected in Cork and Queenstown had proved a great success, but from a financial point of view this branch of the undertaking was very unsatisfactory, as a considerable loss was incurred owing to the exceptionally low rate charged to the Corporation. The Queenstown lighting was still in the preliminary stage, and the capital expenditure to December 31st, 1900, was practically of no earning capacity. To facilitate through traffic along the Grand Parade the line was doubled during the year, and the Western Road extension was opened in December, with very satisfactory results. The Bill promoted in Parliament last year for the extension of the line from Ballintemple to Blackrock received the Royal assent in August, and the line was opened for traffic last month. Through pressure of business, Mr. E. Garcke had been compelled to retire from the board.

The Chairman, in moving the adoption of the report and statement of accounts, said that the first four months of this year, 1901—which are their worst months in the year—they had a little more than £600 increase over the 1900 figures. Taking the population as being 80,000, the fact of their having carried 5,137,141 passengers in the year means that they have carried the whole population of Cork over 64 times. Both from the traction point of view and from lighting and power point of view, Cork was certainly getting the cheapest service of any place in the United Kingdom. The motion was adopted.

Worcester Tramways, Limited.

The directors' report to be submitted to the meeting held at Donington House, W.C., yesterday (Thursday), reads:—

The directors beg to submit their report and statement of accounts for the year ended December 31st, 1900. During the year three additional horses have been purchased on capital account at a cost of £55 2s., and the capital account now stands at £24,657 19s. 3d. The total revenue for the year amounted to £9,828 11s. 10d., and the expenditure to £8,920 8s. 3d. After deducting the amount paid in respect to debenture interest (£523 11s.), there remains a balance of profit of £384 12s. 7d., to which has to be added £569 5s., the amount brought forward from last year, making a total sum of £953 17s. 7d., which the directors propose should be applied as follows:—

Dividend at the rate of 5 per cent. per annum on the shares	£597 18 0
Balance to be carried forward to next account..	356 19 7
	£953 17 7

The Worcester and District Light Railways Order has been confirmed by the Board of Trade. The Worcester Tramways Bill has been remodelled and is now unopposed. The Worcester (Extension) Light Railways Order is awaiting the confirmation of the Board of Trade. Mr. R. P. Sellon has been appointed a director of the company. Mr. J. S. Raworth and Mr. E. Garcke are the directors who retire by rotation, and being eligible, offer themselves for re-election.

	Year ended Dec. 31st, 1899.	Dec. 31st., 1900.
Miles open—(cars)	Miles.	Miles.
Route miles	3·27	3·27
Single line	2·61	2·61
Double line	·66	·66
Miles open:—(omnibuses)	18·5	18·5
Number of passengers carried by cars and omnibuses	1,404,288	1,392,569
Average receipts per passenger	1·61d.	1·63d.
Average expenditure per passenger, including depreciation	1·39d.	1·54d.
Proportion of expenses to receipts, including depreciation	86·73 p.c.	95 p.c.
Number of cars in stock	10	10
Number of 'buses in stock	11	11

Castner-Kellner Alkali Company, Limited.

The report for the year to March 31st states that the result of the trading is a gross profit of £65,581, out of which £15,550 has been expended in repairs, renewals, and additions to the working plant, and, though a portion of this expenditure might be charged to capital, the directors recommend that the whole amount be paid out of revenue. The net profit is £45,011, which, with £3,768 brought forward from last year, gives £48,779. An interim dividend at the rate of 8 per cent. per annum was paid for the six months ended September 30th, and the directors now recommend that £10,000 be appropriated to depreciation reserve, increasing that account to £25,000, and that one-half of the suspense account (law suits) and one-fifth of the expenses and costs of the amalgamation, amounting together to £5,364, be written off, and that a dividend at the rate of 2 per cent. per annum be paid for the six months ended March 31st, making 5 per cent. for the year, carrying forward a balance of £2,266.

Ruston, Proctor & Co., Limited.

The report, made up to March 31st, states that the balance of profit is £29,956. After deducting depreciation of buildings, plant, and machinery, and office furniture, directors' remuneration, and interest on debentures, there is a net balance of £10,026. The directors recommend the transfer from equalisation of dividends account of the sum of £5,000, making, with the balance brought forward, £16,142. They propose to pay a dividend of 5 per cent. per annum, leaving a balance to be carried forward of £1,517. The less favourable results of the year's trading are due to the abnormally high prices of material and fuel which have ruled during the greater part of the financial year, and also to the fact that, owing to the sudden fall during the latter months of the year under review, it has been deemed prudent to value the stock at the market prices on the date of stocktaking. This item, therefore, stands in the balance-sheet at considerably below its cost.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to the Thames Ironworks Shipbuilding and Engineering Company, Limited, £100,000 5 per cent. registered second mortgage debentures of £100 each. The Committee has further been asked to allow the following securities to be quoted in the Official List:—Aron Electricity Meter, Limited, 125,000

ordinary shares of £1 each, fully paid, Nos. 1 to 125,000 (special application renewed); British Columbia Electric Company, Limited, further issue of 6,400 non-cumulative 5 per cent. preference shares of £10 each, fully paid; Eastern Telegraph Company, Limited, further issue of £103,919 3½ per cent. preference stock. The Committee has appointed special settling day as under:—Thursday, May 30th, General Electric Company (1900), Limited, 18,000 5 per cent. cumulative preference shares of £10 each, fully paid, Nos. 7,001 to 25,000; and £150,000 4 per cent. first mortgage debenture stock, and has ordered same to be officially quoted.

Prospectus.—The list of applications closes to-day in an issue of £100,000 6 per cent. first mortgage debenture stock of the Kettle River Power Company, Limited, which has a share capital of £220,000. The company has been formed by the London and British Columbia Goldfields, Limited, to carry out and develop the charter, rights and concessions of the Cascade Water Power and Light Company, Limited, who have powers to utilise the Cascade Falls of the Kettle River for the purpose of generating and supplying electricity for power, light, and heat in a 40-mile radius from Grand Forks City, Rossland, Cascade, Grand Forks, Phœnix, Anaconda, &c., and also the mines and smelters of both the Rossland and Boundary Districts situated in the radius. The directors intend to commence with the installation of 2,000 H.P., which is estimated to cost about £90,000.

Telegraph Manufacturing Company.—The directors after providing for depreciation and preference dividend for the year ended March 31st last, and placing £6,500 to reserve, recommend a dividend on the ordinary shares for the half-year ended March 31st at the rate of 12 per cent. per annum, and a bonus of 2 per cent. (which, with the interim dividend paid in December last, is at the rate of 10 per cent. for the year, and a bonus of 2 per cent.), carrying forward £7,500. In addition, the premium, amounting to £20,000, received on the issue of new ordinary shares in 1900, has been placed to reserve fund.

Coming Issue.—A morning paper says that before Whitsuntide an issue of £250,000 6 per cent. preference shares of the British Westinghouse Electric and Manufacturing Company, Limited, will be made. It is stated that over £100,000 of these shares have been already applied for.

Western Telegraph Company, Limited. — The directors have declared an interim dividend of 3s. per share, or at the rate of 6 per cent. per annum, free of income-tax, for the quarter ending March 31st, 1901, and payable on June 24th. The transfer books will be closed from June 17th to June 22nd.

TRAFFIC RECEIPTS.

Blackburn Corporation Tramways.—The receipts for the week ending May 17th were £539; corresponding week last year, £439; increase, £100. Total to date, £8,851; corresponding period last year, £7,889; increase, £962. Miles of track open, 8½.

Blackpool and Fleetwood Tramways.—The receipts for the week ending May 18th were £413; corresponding week last year, £526; decrease, £113. Total to date, £4,698; corresponding period last year, £5,110; decrease, £412.

ristol Tramways and Carriage Company.—The receipts for the week ending May 17th were £4,480; corresponding period last year, £2,764; increase, £1,666.

Central London Railway.—The receipts for the week ending May 18th, were £6,39 ; previous week, £6,514; decrease, £116. Total receipts to date (20 weeks), £123,935. Miles open, 6.

City and South London Railway.—The receipts for the week ending May 19 h were £1,902; corresponding week last year, £1,339; increase (Moorgate extension open) £563. Total to date, £33,633; corresponding period last year, £24,965; increase, £14,668. Miles open, 1901, 4½; 1900, 3½.

Dover Corporation Tramways.—The receipts for the week ending May 18th were £188 4s. 10½d.; corresponding week last year, £173 8s. 7½d.; increase, £14 6s. 3d. Total to date, £3,456 4s. 10½d.; corresponding period last year, £3,194 7s. 5d.; increase, £261 17s. 5½d. Miles of track open, 3; Car miles run, 1901, 5,071; 1900, 4,944. Number of cars, 1901, 11; 1900, 11.

Dublin United Tramways Company.—The receipts for the week ending May 17th were as follows:—D. U. T. Co., electric cars, £3,776 19s. 6d.; D. S. D. Co., electric cars, £912 10s. 10d.; total £4 689 10s. 4d.; corresponding week last year—D. U. T. Co., electric cars, £3,247 3s. 4d.; ditto, horse cars, £52 6s. 10d.; D. S. D. Co., electric cars, £759 9s. 2d.; total, £4,058 19s. 4d.; increase, £630 11s.; aggregate to date, £78,538 18s.; aggregate to date last year, £79,746 17s. 6d.; decrease, £1,207 19s. 6d. The mileage worked is 45 miles electrically, as against 42 miles electrically, and 2 miles by horses, for the corresponding period last year.

Glasgow Corporation Tramways.—Receipts for week ending May 18th, 1901, £11,411 5s. 1d., as compared with £9,714 8s. 8d. for same period last year.

Liverpool Overhead Railway.—The receipts for the week ending May 19th were £1,644; corresponding week last year, £1,476; increase, £168. Total to date, £30,811; corresponding period last year, £28,228; increase, £2,583. Miles open, 6 miles 57 chains.

STOCKS AND SHARES.

Wednesday Evening.

It is rest which the Stock Exchange wants after its month of tension, and rest it is now having. The markets are calm as the proverbial millpond, and the fluctuations in American Rails are caused entirely by the dealing on the other side of the Atlantic. The "House" is remarkably quiet, a matter for congratulation according to some, and, on the whole, not a bad thing by any means, as it will permit of prices gradually recuperating.

The easier situation in the Yankee market was reflected by a slight rise—quickly to be lost—in Anglo-American Telegraph Deferred, the most speculative stock in our lists. There is no improvement in the Ordinary and the Preferred, which continue well. Other American telegraph securities are unchanged, but the Eastern group is harder. Eastern Ordinary has advanced, for the third successive week. "Chinas" are the same as before, but the jobbers in the market report a better demand for both investments, the public sensibly taking advantage of the 5 per cent. now offered them.

All the Eastern Extension shares are now ranking equally, and there is no difference between shares No. 1 and No. 300,000.

Amazon Debentures have shot up another four points, and the £10 fully-paid shares are quoted at 4 middle. There are one or two persistent buyers about, after the market has stagnated for years. Great Northerns have a heavy tendency, and mark a decline of 20s. The droopy feeling seems to be more due to fears of sales than to actual selling. Western Telegraph 5 per cent. Debentures are better at 103½: they are redeemable, it may be remarked, in 1906. The chief alterations in the Telegraph list are three severe falls which have occurred in the Ordinary and Preference shares of the West India and Panama Company upon the passing of dividends on Preference and Ordinary alike.

National Telephone descriptions maintain their higher levels, at which they are fairly supported. The only quotable change in this section has been made by Chili Telephones, which at 3⅜ have recovered the 5s. that they lost last week. Orientals are a sixteenth under par.

The electricity supply division records a few improvements, and some of the better class Preference shares are being inquired for. This has led to a hardening of the prices of Charing Cross Preference and County Preference, which display rises of 5s. and 10s. respectively. County 4½ per cent. Second Debenture is 101 to 103. Buyers of Metropolitans are still to the fore, and the price, at 13½, is the fraction up on the week, while the new shares at the same figure are £1 higher. The happy ending to the Marylebone dispute promises to recompense in some small degree for the worry and anxiety which Metropolitan shareholders suffered for so long a period. Edmundson's Ordinary, by the addition of 5s. to their price, have obtained a premium of 10s. above their par value of £5. Westminsters fail to recover the ground they lost a week ago, but "Jimmies" are ½ up.

The interesting feature of the electric railway department is a negative one; City and South London stock has not moved. Its mysterious appreciation has received a check, and we should not be surprised to see a sagging reaction set in. Twopenny "tubes" are harder as regards the Deferred Halves. The see-saw nature of this market is well illustrated by the advance in Deferred, following close upon a fall in the Preferred Halves, which latter has not been made up. The Deferred now stand rather higher than the others; a fortnight since, and matters were reversed. London United Tramways Debentures are 103 to 104, and the Central London's great feeder is as popular as ever. Whitsuntide traffics should prove enormous.

The Potteries Electric Traction Company is issuing some 2,000 new shares *pro rata* to existing shareholders. With so insignificant a number the market naturally is exceedingly limited, but nominal premiums of ½ and 1/16 are now quoted on the Ordinary and Preference respectively. The old Ordinary being 11½ and the old Preference 10½, it will be seen that there is not much in the way of a bonus offered. British Electrics remain at 15, and the Preference at 12½. New General Traction Ordinary are 3½ for the £5 shares fully paid, and the company's 6 per cent. Preference of like denomination, are 4⅜, *ex* the recent dividend of 6s. per share.

Buenos Ayres and Belgrano "A" Preference at 5½ present attractions to the speculative investor; the "B" are 5¼. Keeping to the foreign list of tramways, Cape Electrics seem to have made 1⅜ their resting place, just as Anglo-Argentine shares never get away for long from £4, their present price. Barcelona Trams are a limited market at 9, and the Royal tour has not yet succeeded in vitalising Brisbane Electric Tramways Investment shares; the Ordinary languish at 3, £5 paid, and the 5 per cent. Preference are 4½. These are in worse case than the British Columbia Electric Railway shares, where the £10 Ordinary are quoted at 6¾, while the Preference, non-cumulative, will fetch 9½ *ex* dividend. Business is being done in Calcutta Trams on the basis of £11 per share.

In the manufacturing division, Telegraph Constructions are marked down, but against this can be set a rise in Brush Preference, of which there is some shortage in the market. Underwriting prospectuses of Thornycroft & Co. are in circulation, and details of the well-known business will probably be published in a few days time.

SHARE LIST OF ELECTRICAL COMPANIES.—TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. ‡	Dividends for the last three years. 1898.	1899.	1900.	Closing Quotation May 15th.	Closing Quotations May 22nd.	Business done during week ended May 22nd, 1901. Highest.	Lowest
96,900	African Direct Telegraph, 4 % Debs	100	...	...	...	99 —102	99 —102	...	...
119,700£	Amazon Telegraph 5 % Debs., Nos. 1 to 1,250 Red. ...	100	...	...	...	66 — 71	55 — 65	...	...
822,700£	Anglo-American Telegraph	Stock	£3 9s.	73/6	3½%	53 — 56	53 — 56	...	...
3,088,540£	Do. do. 6 % Pref	Stock	6 %	6 %	6 %	97 — 99	97 — 99	98⅜	98
3,088,540£	Do. do. Deferred	Stock	18s. %	£1 7s.	5s.%	10 — 10½	10 — 10½	10½	10¼
44,000	Chili Telephone, Nos. 1 to 44,000	5	3 %	4 %	...	3¼— 3⅜	3½— 4	...	...
13,333,300$	Commercial Cable	$100	8 %	8 %	...	175 —185	175 —185	...	...
1,589,496£	Do. do. Sterling 500 year 4 % Deb. Stock Red.	Stock	...	...	...	100 —102	100 —102	104¼	101¼
16,000	Cuba Telegraph	10	8 %	7 %	...	7 — 8	7 — 8	...	...
6,000	Do. 10 % Pref.	10	10 %	...	...	15 — 16	15 — 16	...	...
12,931	Direct Spanish Telegraph	5	4 %	4 %	4 %	3 — 4	3 — 4	...	...
6,000	Do. do. 10 % Cum. Pref.	5	...	...	...	9 — 10	9 — 10	...	...
30,000£	Do. do. 4½ % Debs.	50	...	...	...	100 —104%	100 — 104%	...	...
60,710£	Direct United States Cable	20	3½%	3 %	3 %	10 — 10½	10 — 10½	...	...
108,300£	Direct West India Cable, 4½ % Reg. Deb.	100	...	...	...	100 —103	100 —103	...	...
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	...	139 —144	140 —145	143	140⅜
1,826,888	Do. 3½ % Pref. Stock	100	...	...	...	91 — 94	91 — 94	93¼	93
1,432,268£	Do. 4 % Mort. Deb. Stock Red.	Stock	...	...	...	110 —114	110 —114	...	...
250,000	Eastern Extension, Australasia, and China Telegraph ...	10	7 %	7 %	7 %	13½— 14	13½— 14	14	13 13/16
50,000	Do. Nos. 250,001 to 300,000 (iss. at £3 pm. all pd.) ...	10	...	...	...	13½— 14xd	13½— 14	...	...
320,000£	Do. 4 % Deb. Stock	Stock	...	...	...	111 —116	111 —116	112	...
300,000£	Eastern and South African Telegraph, 4 % Mort. Deb. Nos. 1 to 3,000, red. 1909	100	...	...	...	99 —102	100 —103	102	100¼
200,000£	Do. 4 % Reg. Mt. Debs. (Mauritius Sub.) 1—8,000	25	...	...	...	100 —103%	100 —103	...	...
180,227	Globe Telegraph and Trust	10	5½%	5½%	...	9½— 10	9½— 10	9 15/16	9⅞
180,042	Do. do. 6 % Pref.	10	6 %	...	...	14¾— 15½	14¾— 15¼xd	15⅛	14 13/16
150,000	Great Northern Telegraph, of Copenhagen	10	12½%	...	15 %	33 — 35	32 — 34	...	...
82,000£	Halifax and Bermuda Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	...	...	...	100 —103	100 —103	...	...
17,000	Indo-European Telegraph	25	10 %	10 %	10 %	43 — 47	47 — 47 xd	...	...
100,000£	London Platino-Brasilian Telegraph, 6 % Debs.	100	...	...	...	103 —106	103 — 106	...	...
72,680	Montevideo Telephone, Limited, Ord., Nos. 1 to 72,680 ...	1	...	2½%	...	¼— ½	¼— ½	...	...
86,492	Do. do. do. 5 % Pref., Nos. 1 to 86,492	1	4 %	5 %	...	¾— 1	¾— 1	...	...
590,000	National Telephone, 1 to 590,000	5	6 %	5 %	5 %	3⅜— 3⅝	3⅜— 3⅝	3 9/16	3⅜
15,000	Do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	10 — 12	10 — 12	11½	...
15,000	Do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	10 — 12	10 — 12	11 7/16	...
250,000	Do. 5 % Non-cum. 3rd Pref., 1 to 250,000	5	5 %	5 %	5 %	4¼— 4⅜	4¼— 4⅜	4 5/16	4 5/16
2,000,000£	Do. 3½ % Deb. Stock Red.	Stock	3½%	3½%	3½%	87 — 90	87 — 90	...	...
500,000£	Do. 4 % Deb. Stock Red....	100	...	...	4 %	95 — 98	95 — 98	97⅜	96
171,504	Oriental Telephone and Elec., Nos. 1 to 171,504, fully paid	1	5 %	5 %	6 %	⅞— 1	⅞— 1 xd	...	...
100,000£	Pacific and European Tel., 4 % Guar. Debs., 1 to 1,000 ...	100	...	...	...	100 —103	100 —103	...	...
11,839	Reuter's...	8	5 %	5 %	5 %	7½— 8½	7½— 8½	7½	...
3,381	Submarine Cables Trust	Cert.	...	...	...	124 —129	121 —126	...	...
58,000	United River Plate Telephone	5	6 %	7 %	...	4½— 5	4½— 5	...	...
40,000	Do. do. 5 % Cum. pref. Nos. 1—40,000	5	...	...	...	4⅝— 5½	4⅝— 5½	...	...
179,947£	Do. do. 5 % Debs.	Stock	...	...	...	103 —106	103 —106	...	...
171,000	West African Telegraph, 5 % Debs....	100	...	...	...	98 —101	98 —101	...	...
30,008	West Coast of America, Nos. 1—30,000 and 53,001—53,008	2½	...	...	...	¼— ⅜	¼— ⅜	...	...
150,000£	Do. do. 4 % Debs., 1—1,500 gua. by Bras. Sub. Tel.	100	...	...	...	100 —103	100 —103	...	...
207,930	Western Telegraph, Ltd., Nos. 1—207,930	10	7 %	7 %	...	13⅜—14½	13⅜— 14½	14	13⅜
75,000£	Do do. 5 % Debs. 2nd series, 1906 ...	100	...	...	...	101 —104	101 —104	103	...
348,777£	Do. do. 4 % Deb. Stock Red.	100	...	...	...	102 —105	102 —105	...	...
88,321	West India and Panama Telegraph	10	2 %	5%	...	⅝— ⅞	⅜— ⅝	7 16	...
34,563	Do. do. do. 6 % Cum. 1st Pref. ...	10	...	...	...	6 — 7	5 — 6	6⅝	...
4,669	Do. do. do. 6 % Cum. 2nd Pref. ...	10	...	...	...	5 — 7	3 — 5	...	...
80,000£	Do. do. do. 5 % Debs., Nos. 1 to 1,800	100	...	...	...	103 —106	103 —106	...	...

ELECTRICITY SUPPLY COMPANIES.

19,661	Brompton & Kensington Elec. Lt. Sup., Ord., 101 to 19,761	5	6 %	6 %	6 %	7⅞— 8¼	7⅞— 8¼	...	...
12,000	Do. do. 7 % Cum. Pref....	5	...	...	...	8½— 9	8½— 9	...	...
50,000	Charing Cross and Strand Electricity Supply	5	8 %	9 %	9 %	9 — 10	9 — 10	...	...
20,000	Do. do. do. do. 4½% Cum. Pref.	5	...	...	...	5 — 5½	5½— 5⅝	5 7/16	5⅜
34,000	*Chelsea Electricity Supply, Ord.	5	6 %	6 %	5½%	5⅝— 6¼	6 — 6½	...	...
150,000£	Do. do. do. % Deb. Stock Red. ...	Stock	...	...	...	109 —112	109 —112	111½	...
70,579	City of London Electric Lighting, Ord. 40,001—110,579...	10	6 %	4 %	0 %	8½— 9½	8½— 9½	8½	...
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	12 — 13	12 — 13	12⅝	...
400,000£	Do. 5 % Deb. Stock, Scrip. (iss. at £115) all paid	...	...	...	...	122 —127	122 —127	...	...
40,000	County of Lond. & Brush Prov. Elec. Ltg., Ord. 1—40,000	10	nil	4 %	4 %	8 — 9 xd	8 — 9	7⅞	8½
20,000	Do. do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	11 — 12 xd	11½— 12½	12⅛	12 1/16
200,000£	Do. 4½ % Deb. Stock, Prov. Certs (all paid) Rd. ...	...	...	...	...	105 —108	105 —108	...	...
35,500	Edmundson's Elec. Corp., Ord. Shares	5	7 %	...	...	5 — 5½	5½— 5¾	5½	...
13,363	Do. do. 6 % Cum. Pref.	...	...	...	...	5½— 6	5½— 6	...	...
75,000£	Do. do. 4½ % 1st Mort. Deb. Stock. ...	100	...	...	...	103 —106	104 —107	...	...
21,000	Kensington and Knightsbridge Electric, Ord.	5	...	...	...	11 — 12	11 — 12	11 3/16	...
90,000	Do. do. do. 4 % Deb. Stock	Stock	...	...	...	102 —105	102 — 105	...	...
110,000	London Electric Supply Corporation, Limited, Ord. ...	3	...	...	...	1½— 1⅝	1½— 1⅝	...	...
49,840	Do. do. do. do. 6 % Pref.	5	6 %	...	...	4 — 5	4 — 5	...	...
250,000£	Do. do. do. 4% 1st Mt. Db. Stock Rd.	Stock	...	...	...	98 —101	98 —101	...	...
85,000	Metropolitan Electric Supply, 101 to 62,500	10	5 %	5 %	6 %	12½— 13½	13 — 14	13⅜	13 1/16
220,000£	Do. 4½% First Mortgage Debenture Stock	...	...	...	...	110 —113	110 —113	111½	...
250,000£	Do. 3½% Mort. Deb. Stock Red.	Stock	...	...	...	96 — 99	96 — 99	...	...
6,452	Notting Hill Electric Lighting	10	6 %	7 %	7 %	15½— 16½	15½— 16½	...	...
40,000	St. James's and Pall Mall Electric Light, Ord.	5	14½%	14½%	14½%	14 — 15	14½— 15½	15	...
20,000	Do. do. 7 % Pref., 20,081 to 40,080	5	7 %	7 %	7 %	8½— 9½	8½— 9½	...	...
150,000£	Do. do. 3½ % Deb. Stock Red. ...	100	...	...	...	98 —101	98 —101	...	...
12,000	Smithfield Market Elect. Supply, Ord.	5	...	...	...	2 — 2½	2 — 2½	...	...
50,000£	Do. do. 4 % Deb.	100	...	...	...	80 — 90	80 — 90	...	...
65,000	South London Electricity Supply, Ord.	5	...	...	...	2½— 3½	2½— 3½	...	...
79,900	Westminster Electric Supply, Ord., 101 to 80,000... ...	5	12 %	13 %	10½%	12 — 13	12 — 13	12½	12⅜

* Subject to Founders Shares.
Unless otherwise stated all shares are fully paid.
Dividends marked ‡ are for alyear consisting of

Quotations on Liverpool Stock Exchange.
| Dividends paid in deferred share warrants, profits being used as capital
the latter part of one year and the first part of the next.

SHARE LIST OF ELECTRICAL COMPANIES.—*Continued.*

ELECTRICAL RAILWAY, MANUFACTURING, AND INDUSTRIAL COMPANIES.

Present Issue.	NAME.	Stock or Share.	Dividends for the last three years. 1898.	1899.	1900.	Closing Quotation May 15th.	Closing Quotation May 22nd.	Business done week ended May 22nd, 1901. Highest	Lowest
20,000	British Aluminium 7 % Cum. Pref.	10	... ...			7½ — 8½	7½ — 8½	...	...
300,000*l*	Do. do. 5 % 1st Mort. Deb. Stock Red. ...	Stock	... ...			87 — 93	85 — 93	...	...
45,000	British Electric Traction	10	6 %			14½ — 15½	14½ — 15½	15½	14⅞
50,000	Do. do. 6 % Cum. Pref.	10	... ...			12 — 13	12 — 13	12⅝	12⅜
350,000*l*	Do. do. 5 % Perpetual Debenture Stock ...	Stock	... ...			119 —122	120 —123	121	...
85,000*l*	†British Electric Works Co., Ord. £1 shares, 50,001—135,000	...	... ...			... ...	... ...	...	...
50,000	† Do do. 6 % Cum.Pref., 1—50,000 ...	...	... ...			... ...	... ...	...	...
500	† Do. do. 4½ % 1st Mort. Deb.	100	... ...			... ...	... ...	...	...
70,000	British Insulated Wire Ord.	5	15 % 20 % 15 %			10 — 11	10 — 11	...	...
70,000	Do. do. 6 % Cum. Pref.	5	... ...			5⅝ — 6½	5⅝ — 6½	...	...
90,000	Brush Elecl. Enging., Ord., 1 to 90,000	2	5 % 6 % ...			1⅝ — 1¾xd	1⅝ — 1¾	...	...
90,000	Do. do. Non-cum. 6 % Pref., 1 to 90,000 ...	2	6 % 6 % ...			2 — 2⅛xd	2⅛ — 2⅜	...	...
125,000*l*	Do. do. 4½ % Perp. Deb. Stock	Stock	... ...			103 —108	103 —108	...	...
108,710*l*	Do. do. 4½ % Perp. 2nd Deb. Stock ...	Stock	... ...			101 —103	101 —104	...	...
30,000	Callender's Cable Construction shares, Nos. 1—30,000 ...	5	15 % 15 % 15 %			14½ — 15½	14½ — 15	15	...
40,000	Do. do. 5 % Cum. Pref.	5	... ...			5½ — 6	5½ — 6	5⅞	5½
90,000*l*	Do. do. 4½ % 1st Mort. Deb. Stock Red ...	Stock	... ...			109 —113	109 —113	...	...
206,297	Central London Railway, Ord. Shares	10	... ...			9½ — 10	9½ — 10	9⅝	9½
78,703	Do. do. Pref. half-shares	5	... ...			4⅛ — 5	4⅛ — 5	4⅞	4 13/16
78,703	Do. do. Def. do.	5	... ...			4½ — 5	4⅝ — 5½	...	...
855,000	City and South London Railway	Stock	2⅛% 1⅞% 1¾%			52 — 54	51 — 53	..	...
37,500	Do. do. Ord. shares Nos. 22,501 to 60,000	10	... ...			5 — 5½	5 — 5½	...	...
54,000	Crompton & Co., Nos. 1 to 54,000	3	6 % 7½% ...			3½ — 4	3½ — 4	...	...
100,000*l*	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 red	...	... ...			101 —104	101 —104	...	...
99,261	Edison & Swan Utd. El. Lgt., "A" shares, £3 pd. 1 to 99,261	5	6 % 6 % ...			1 — 1⅛	1 — 1⅛	...	...
17,139	Do. do. do. "A" Shares, 01—017,139 ...	5	6 % 6 % ...			2½ — 3½	2½ — 3½	...	...
344,023*l*	Do. do. do. 4 % Deb. Stock Red ...	100	... ...			87 — 89	87 — 89	...	...
100,000*l*	Do. do. 5% 2nd Deb. Stock Prov. Certs. all pd.	100	... ...			94 — 98	94 — 98	...	...
112,100	Electric Construction, 1 to 112,100	2	6 % 6 % ...			1⅜ — 2½	1⅜ — 2½	...	...
25,000	Do. do. 7 % Cum. Pref., 1 to 25,000... ...	2	7 %			2⅜ — 3	2⅜ — 3	...	...
182,500*l*	Do. do. 4 % Perp. 1st Mort. Deb. Stock ...	Stock	... ...			101 —104	101 —104	...	...
35,000	Henley's (W. T.) Telegraph Works, Ord.	5	14 % 15 % 20 %			15½ — 16⅜	15½ — 16⅜	...	...
35,000	Do. do. do. 4½ % Pref.	5	... 4½% 4½%			5⅜ — 6	5⅜ — 6	...	...
50,000*l*	Do. do. do. 4½ Mort. Deb. Stock...	Stock	... ...			107 —111	107 —111	...	...
50,000	India-Rubber, Gutta-Percha and Telegraph Works ...	10	10 % 10 % ...			21 — 22	21 — 22	21½	...
300,000*l*	Do. do. do. 4 % 1st Mort. Deb	100	... ...			101 —104	101 —104	...	...
37,500	†Liverpool Overhead Railway, Ord.	10	3½% 3⅜% 3½%			7 1/16 — 8 1/16	8 1/16 — 8 3/16	...	...
10,000	† Do. do. Pref., £10 paid	10	5 % 5 % ...			13 — 13½	13 — 13½	...	...
37,350	Telegraph Construction and Maintenance	12	15 % 15 % 17½%			36 — 39	35 — 39	36½	36
150,000*l*	Do. 4 % Deb. Bds. Nos. 1 to 1,500 Red. 1909 ...	100	... ...			102 —105	102 —105	...	...
20,000	Telegraph Manufacturing, Ord. Nos. 1 to 20,000	5	8 % 12 % 12 %			10½ — 11½	10½ — 11½	...	...
20,000	Do. do. 5 % Cm. Prf. Nos. 1 to 20,000 ...	5	... ...			5½ — 6	5½ — 6	...	...
540,000*l*	Waterloo and City Railway, Ord. Stock	100	3 % 3 % 3 %			94 — 97	94 — 97	94½	...

† Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated all shares are fully paid.

LATEST PROCURABLE QUOTATIONS OF SECURITIES NOT OFFICIALLY QUOTED.

Consolidated Telephone Construction and Maintenance, 3/—4/.
National Electric Free Wiring, 12/6 paid, ⅞—1⅛.

Oldham, Ashton, and Hyde Electric (£10 pd.), Ord., 16—17.
Do. do. Pref. (£10 pd.), 10—11.
*T. Parker, £10 (fully paid), 16½.

* From Birmingham Share List.

Bank rate of discount 4 per cent. (February 21st, 1901).

MARKET QUOTATIONS, Wednesday, May 22nd.

CHEMICALS, &c.		This week.	Last week.	Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	5/-	..
a ,, Nitric	per cwt.	22/-	22/-	..
a ,, Oxalic	per cwt.	32/-	32/-	..
a ,, Sulphuric	per cwt.	5/6	5/6	..
a Ammoniac, Sal	per cwt.	80/-	80/-	..
a Ammonia, Muriate (crystal) ..	per ton	£33 10	£33 10	..
a ,, ,, ..	per ton	£30	£30	..
a Bleaching powder	per ton	£7	£7	..
a Bisulphide of Carbon	per ton	£15	£15	..
a Borax	per ton	£17 10	£17 10	..
a Bensole (90 %)	per gal.	7/-	7/-	..
a ,, (50/90%)	per gal.	5/6	5/6	..
a Copper Sulphate	per ton	£23	£23	..
a Lead, Nitrate	per ton	£24	£24	..
a ,, White Sugar	per ton	£31	£31	..
a ,, Peroxide	per ton	£27 10	£27 10	..
a Methylated Spirit	per gal.	2/6	2/6	..
a Naphtha, Solvent (90% at 160° C).	per gal.	5/6	5/6	..
a Potash, Bichromate, in casks ..	per lb.	3½d.	3½d.	..
a ,, Caustic (75/80%) ..	per ton	£24	£24	..
a ,, Bisulphate	per ton	£35	£35	..
a Shellac	per cwt.	61/-	61/-	..
a Sulphate of Magnesia	per ton	£4 10	£4 10	..
a Sulphur, Sublimed Flowers ..	per ton	£6 5s.	£6	..
a ,, Recovered	per ton	£5 10	£5 10	..
a ,, Lump	per ton	£5	£5	..
a Soda, Caustic (white 70 %) ..	per ton	£10 15	£10 15	..
a ,, Crystals	per ton	£3	£3	..
,, Bichromate, casks ..	per lb.	2¾d.	2¾d.	..

METALS, &c.				
b Aluminium Wire, in ton lots ..	per ton	£224	£224	..
b ,, Sheet, in ton lots	per ton	£191	£191	..
p Babbitt's metal ingots	per ton	£75 to £140	£75 to £130	inc.
c Brass (rolled metal 2" to 12") basis	per lb.	7½d.	7½d.	..
c ,, Tube (brazed)	per lb.	10d.	10d.	..
c ,, ,, (solid drawn) ..	per lb.	8½d.	8½d.	..
c ,, Wire, basis	per lb.	8d.	8d.	..
c Copper Tubes (brazed) ..	per lb.	11d.	11d.	..
c ,, ,, (solid drawn) ..	per lb.	10¾d.	10¾d.	..
g Copper Bars (best selected) ..	per ton	£85	£85	..

METALS, &c. *(continued.)*		This week.	Last week.	Inc. or Dec.
g Copper Sheet	per ton	£85	£85	..
g ,, Rod	per ton	£85	£85	..
c ,, (Electrolytic) Bars ..	per ton	£82	£82	..
,, ,, Sheets ..	per ton	£90	£90	..
c ,, ,, Rod ..	per ton	£84	£84	..
c ,, ,, H.C. Wire ..	per lb.	9¾d.	9¾d.	..
f Ebonite Rod	per lb.	8/-	8/-	..
f ,, Sheet	per lb.	5/-	5/-	..
h German Silver Wire	per lb.	1.5	1/5	..
h Gutta-percha fine	per lb.	8/-	8/-	..
h India-rubber, Para fine	per lb.	3/0½ to 3/10½	3/9 to 3/9½	inc.
i Iron, Charcoal Sheets	per ton	£18	£18	..
i ,, Pig (Cleveland warrants) ..	per ton	45/10	46 3	5d. dec.
i ,, Forgings, according to size	per ton	From £11	From £11	..
i ,, Scrap, heavy	per ton	70/- to 72/6	70/- to 72/6	..
i ,, Wire, galvanised No. 8 ..	per ton	£10 5	£10 5	..
g Lead, English Ingot	per ton	£12 10 to £12 12 6	£12 10 to £12 15	dec.
g ,, ,, Sheet	per ton	£13 10	£15	£1 10 dec.
m Manganin Wire No. 28	per lb.	8/-	8/-	..
g Mercury	per bot.	£9 2 6	£9 2 6	..
d Mica (in original cases), small ..	per lb.	3d. to 9d.	3d. to 9d.	..
d ,, ,, ,, medium	per lb.	1/9 to 2/9	1/9 to 2/9	..
d ,, ,, ,, large ..	per lb.	3/3 to 7/3	3/3 to 7/3	..
p Phosphor Bronze, plain castings	per lb.	1/0½ to 1/3	1/0½ to 1/3	..
p ,, rolled bars & rods	per lb.	1/1 to 1/4	1/1 to 1/4	..
p ,, ,, strip & sheet	per lb.	From 1/3	From 1/3	..
o Platinum	per oz.	£4 1	£4 1	..
p Silicium Bronze Wire	per lb.	10½d. to 1/0½	10½d. to 1/0½	..
i Steel, Magnet, acc'd'ng to desc'p'n	per ton	From £15	to £40	..
i ,, ,, in bars		£58	£58	..
g Tin, block	per ton	£130 to £131	£124 10 to £125 10	£5 10 inc.
g ,, foil	per lb.	1 6	1/9	3d. dec.
n ,, wire, Nos. 1 to 16	per lb.	1/8	1/8	..
p White Anti-friction Metals — "White Ant" brand	per ton	£35 to £65	£35 to £65	..
j Yarns, Cotton, Single 10 lb. b'ndl's	per lb.	8½d.	8½d.	..
j ,, Best Flax, 6 lea.	per lb.	6d.	6d.	..
j ,, Hemp, 8 ply 10 lbs. ..	per lb.	4½d.	4½d.	..
j ,, ,, Russian, 10 lbs. ..	per lb.	5½d.	5½d.	..
j ,, Jute, 180 lbs. rove ..	per ton	£14 5	£14 5	..
k Zinc, Sh's. (Vielle Montagne ond.)	per ton	£22 10	£21 10	£1 inc.

Quotations supplied by { a Messrs. G. Boor & Co. b The British Aluminium Co., Ltd. c Messrs. Thos. Bolton & Sons. d Messrs. F. Wiggins & Sons. e Messrs. Frederick Smith & Co.

Quotations supplied by { f India-Rubber, G.-P. and Teleg. Works g Messrs. James & Shakspeare. [Co., Ltd. h Messrs. Jackson & Till. i Messrs. Bolling & Lowe. j Messrs. Henry C. Yee & Co.

Quotations supplied by { k Messrs. Morris Ashby, Limited m Messrs. W. T. Glover & Co., Ltd. n Messrs. P. Ormiston & Sons. o Messrs. Johnson, Matthey & Co., Ltd. p The Phosphor Bronze Company, Ltd.

COMBINED ELECTRIC TRAVERSER AND CAPSTAN.

The adjoining illustration shows a 10-ton traverser that has been built to the design of Mr. W. A. Walton, A.M.I.E.E., Gloucester, and which has been at work for several months. It is used for traversing coal wagons, which are built in shops lying on either side of the traverser road.

The total length of track is 450 ft., and the gauge 11 ft. 1½ in. There are two 0·27-in. diameter overhead conductors, positive and negative, 16 in. apart, fed at a convenient point from a power and lighting plant, which did not admit of a rail return being used. The conductors are 13 ft. 6 in. above the ground, and insulated throughout with standard tramway material, the intermediate supports being span wires. The double trolley is in the form of a Y, with separate springs, and adjustment to each arm.

The locomotive is readily detached from the traverser proper, and has four wheels 1 ft. 7 in. diameter, and wheelbase 3 ft. 6 in., the underframe being slung beneath the axles to keep the centre of gravity low, thereby securing stability whilst hauling.

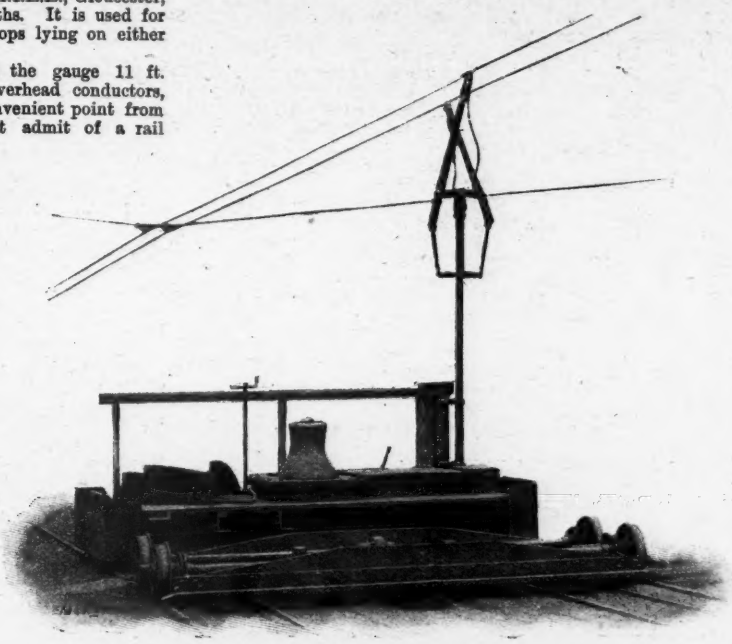
The capstan is driven at 50 revolutions per minute through worm gear, the worm spindle being coupled to the motor, and the whole is self-contained in a cast-iron box. The worm, worm-wheel and thrust collars are partially submerged in thick oil.

The capstan spindle is carried out below the box to drive the spur-wheel travelling gear, which is thrown in or out of gear by a jaw clutch while the motor is at rest.

The capstan hauls at 150 ft. per minute, and the travelling speed is 157 ft. per minute. The motor was specially built to specification by Messrs. Johnson & Phillips; it is of two-pole type with carbon brushes, and over-compounded to provide large starting torque. It gives 6 B.H.P. at 1,200 revolutions per minute on 110 volts, but was made to take a frequent 25 per cent. overload without sparking or heating.

At the end of the platform occupied by the driver are the starting and reversing switches, these being interlocked so that the current must be switched off before the reversing switch can be moved. The clutch lever and a band brake acting on a drum keyed to one of the axles are also near at hand.

The facility with which the traverser does its work indicates that the difficulties presented by the requirements have been successfully met.



Electric Traverser.

IMPORTANT EUROPEAN ELECTRICAL AND ENGINEERING DEVELOPMENTS.*

By WILLIAM J. HAMMER.

(*Continued from page* 819.)

The Langen Mono-Rail Suspended Railway.

Various types of swinging railways have been termed "mono-rail," although it is probable that the Engen-Langen system is the only line to which this term can strictly be applied. The original plan for this road contemplated a two-rail track, but the experts called in by the Barmen and Elberfeld municipalities finally decided upon the single rail plan, it being decided that the mass of the carriage was so great, and its vibrations so slow, that it would be possible to get rid of unpleasant oscillations without its being necessary to use auxiliary rails. Considering certain disadvantages in surface roads, it is claimed that apart from the limits of speed, which points and switches impose, the two rails of surface tracks are themselves detrimental, as they cannot always be kept parallel, or at the same level. The carriages consequently must vibrate, and the permanent structure be affected more or less seriously. On curves in surface lines, the outer rail is raised, care being exercised not to overdo it, and the ratio in the level of the rails varies with the speed. High speed is generally impossible on surface lines, and when elevated structures with double tracks are employed, they are of necessity objectionable from an æsthetic point of view, and they furthermore obscure the light. A mono-rail track will be lighter, and in every way less objectionable. Curves can be managed with but slight oscillations—in fact, curves with radii of 50, 25 and 10 metres have been passed over with speeds of 41, 30 and 16 miles, deflecting the carriages by 35, 36 and 27 degs., and still no motion was felt by the passengers. The carriages on the Elberfeld road do not diverge more than seven degrees. The sharpest curve of the track proper has a radius of 295 feet; and only where some exceptional accident happens to the structure or foundations thereof, is there any danger of derailment. The length of the Elberfeld line, when completed, will be 8¼ miles, 6·2 of which passes over the River Wupper, a tributary of the Rhine, which varies in width from 68 to 115 ft. Barmen, Elberfeld, and Vohwinkel, which towns the railroad connects, are situated in the narrow Wupper Valley. No satisfactory route existed for a surface road, and it was deemed impracticable, on account of the expense and engineering difficulties, to construct an ordinary type of elevated railroad. I was informed by the engineers of the Elektricitäts Aktiengesellschaft (formerly the Schuckert Company), who are constructing the road, and through whose courtesy I was given a special trip over a completed portion of the road at the time of my second visit, on November 12th, 1900, that the total construction expense for the loop track at Elberfeld amounted to $224,000 per mile, and the total cost of the road when completed would not be over $2,500,000 for the 8¼ miles. Sections of the opposite sides of the cars open outwardly, and become a platform, across which the passengers can pass to the cars of a train going in the opposite direction, in case of an accident happening, which disables a car. The doors lock automatically, and the motorman releases the catch. The end platform guard rails can also be lowered so that the passengers can pass into a train following the disabled one. Two telephone wires are attached to the structure, and by means of a bamboo pole, carrying metal clips, connection can be made from any car to the power house, and various stations on the line. Automatic ticket vending boxes are used along the line. The currents supplied to the up-and-down track are separate, and a large storage battery is installed at the central station. Each train consists of two carriages, but may be increased to four or more, all connected together by rods to secure rigidity. In the front compartment of the first carriage, is the controller for all the motors. As the trains always move in the same direction, it is not necessary to have a controller at the other end of the car. Both ends of each car are, however, equipped with hand brakes and automatic Westinghouse air brakes (supplied with a pressure of 115 lbs. per square inch, and having the brake shoes bearing upon the top of the wheels). The cars are also equipped with circuit breakers. Each car is lighted with three clusters of three 16-c.p. lamps each. Five iron pipes, 36 ft. in length and 4 in. in diameter, running under the floor of the car, are used as air tanks, and also serve to strengthen and support the car. Each car is suspended from two bogies, 26 ft. apart, each running on two wheels 35 in. in diameter, which are driven by an electric motor of 36 H.P. by means of spur gearing. The motor is fixed between the two wheels. The lower part of the hook-shaped bogie frame is adjustable. The round rail heads form a centre about which the entire car can oscillate. The bogie frame is just below the girder member, which bears the rail curve to that centre, and the gap between girder and frame, only 0·228, is so small that the wheel cannot jump from the rail, and thus the frame would be held tight by the girder should any part break. The structure is about 25 ft. above the street level, and the lowest portion of the carriage about 15 ft. The weight of the carriage with its load of 50 passengers is estimated at 14 tons, made up as follows:—

Two electric motors with complete electrical outfit	6,743 lbs.
Two bogies with buffers and cross beams ...	3,960 „
Carriage body with seats, complete	12,903 „
Passengers	7,700 „
Total	31,306 lbs.

* Abstract of paper read by Mr. W. J. Hammer before the American Institute of Electrical Engineers, February 28th, 1901.

This would give a carriage weight, including everything, of 618 lbs. per passenger. The superstructure itself weighs only 700 lbs. per foot. The supports are placed at an average distance of 100 ft. apart. It is proposed to run the trains every three minutes, and at an actual speed of 31 miles an hour; the average speed, including stops, will be about 20 miles. With the automatic block signal system installed they may be safely operated at intervals of two minutes. As already stated, the two electric motors of a carriage are of 36 H.P. each. They may be connected in parallel or in series in the usual manner, and operated at 600 volts. The current is taken off the contact rail, which is fixed to the obliquely fastened insulators, by a contact shoe, held by an inclined lever controlled by a compression spring. The contact rail is of iron with a round head, the trolley shoe embracing it and making good contact at any position taken by the carriage. It is estimated that with trains of four carriages 6,000 persons could be despatched per hour in either direction. The rails are $4\frac{1}{2}$ in. high with a round head, and $2\frac{2}{10}$ in. wide, with lap joints. It is estimated that it will take two years more to complete the railroad. At the time of my last visit 12 of the 20 stations were already finished and 26 of the 50 cars completed. Work was started in March, 1898; in January, 1899, a first test of 400 metres was made. On October 24th, 1900, Emperor William was given a special trip over $7\frac{1}{2}$ kilometres, from Vohwinkel to Elberfeld. The operation of this road will be followed by engineers with great interest, and it remains to be seen how great an influence it will have upon future transportation problems. I am indebted to the company's engineers and to *Engineering* for the data presented. I understand some 6,000 engineering drawings were prepared in connection with this notable installation.

The Nernst Lamp.

The Nernst lamp is the invention of Prof. Walther Nernst, of Göttingen Univ., a leading authority in the chemical world, in which his originality had left an important impress before he made his discoveries resulting in the electrolytic lamp. Prof. Nernst informed the author last November at his laboratory in Göttingen that the discovery of the principles underlying his lamp had been made during a series of experiments to determine what caused the efficiency of the Welsbach, or, as it is called abroad, the "Auer" mantle. More or less secrecy has been observed as to the materials used in the Welsbach mantle, but it is well known that certain metallic oxides, such as thorium, yttrium, cerium, zirconium, glucinum, erbium, and others less known, have entered into their manufacture. Probably the first three mentioned are the ones chiefly used, although the ingredients and proportions have been varied from time to time. These very refractory materials are of a yellowish or whitish colour. They are non-volatile, save at exceptionally high temperatures. Prof. Nernst in his early experiments took certain of these highly refractory substances, such as magnesia oxide mixed with porcelain, which form high-class insulators when cold, but which he found were electrolytes when hot. These are termed conductors of the second class, or such chemical substances as are decomposed upon the passage of a direct current. An infinite amount of experimentation has been going on all over Europe and America to find the most suitable substances for these electrolytic filaments, or, as they are termed, "glowers" of the Nernst lamp. According to a recent number of the *Zeitschrift für Elektrochemie*, of which Prof. Nernst is one of the editors, a series of tests have recently been made upon samples of glowers composed essentially of the oxides of zirconium, thorium and yttrium, together with certain rare earths. These glowers were all in the form of thin, straight rods, which required a temperature of 900 to 1,300° F. to render them sufficiently conducting to start them operating with the electrical currents. The following table gives the results of six experiments with these samples. The three figures in each case represent the observations in the beginning and end of the experiments, and the mean values. To obtain the mean spherical candle-power, multiply the candle-power in the table by ·78. The watts given is solely for the energy consumed in the glower itself, and to this should be added from 5 to 15 per cent. for the energy consumed in the steadying resistance in series with the glower, which is indispensable in the actual working lamp:—

Table.

Life (hours).	Volts.	Amperes.	Candle-power.	Watts per candle.
231	184—191	0·21—0·192	28·5—24·5	1·35—1·50
	186	0·206	28·1	1·37
308	181—201	0·22—0·19	30·5—27·0	1·30—1·42
	190	0·20	29·3	1·35
447	190—203	0·41	64—57·5	1·21—1·45
	183	0·41	5[illegible]·7	1·37
249	183—205	0·41—0·40	67—70	1·12—1·17
	192	0·40	65	1·20
522	184—196	0·85—1·0	123—130	1·27—1·50
	189	0·96	129	1·41
334	180—192	0·38	57·7—58	1·19—1·26
	184	0·38	53·5	1·31

The efficiency of incandescent illuminants, as far as radiation goes, depends simply upon the temperature. The carbon filament in an incandescent lamp is structurally too weak, and has too low a specific resistance to stand very high temperatures. The blackening of the globe of an incandescent lamp is indicative of its rapid disintegration, and of the fact that its highest practicable temperature has been reached. Probably the most refractory substances thus far used as illuminants are zirconium, used to replace the lime in the lime light, and the oxides of the so-called rare earths already referred to, used in the Welsbach mantle and the Nernst lamp. It is a well-known fact that the Welsbach incandescent gas mantle falls off in candle-power very rapidly. I believe the loss is about 25 per cent. in the first 60 hours. So closely is the composition of the Nernst filament or glower related to the Welsbach mantle burner, that it is an interesting question as to what extent the Nernst lamp will fall off in its efficiency. The greatest difficulty experienced by the manufacturers has been the proper clamping of the filament. I have examined some of the platinum connections after considerable use, and they seemed to have been eaten away, and even the glower itself is slightly diminished in thickness and become crystalline near the anode or positive pole in lamps run on a continuous current. Many experiments have been made to obviate this difficulty, such as forming a blob of refractory material around the platinum connections, and bringing the platinum wire to the surface to reduce somewhat the temperature by radiation. There seems to have been also considerable difficulty caused by expansion, which the London Nernst Company claims to have obviated by running a platinum wire from the end of the glower through a loop in the supporting wire, enabling the platinum to slide back and forth in this loop. The end of the platinum wire is bent down, and attached to the supporting wire below the loop. The London company states that this has lessened the breakage considerably.

The simplest form of Nernst lamp manufactured by the London company, which is of 16 C.P. at 100 volts, requires an alcohol torch or a match to heat up the glower at starting; the globe of the lamp is open at the bottom to permit of this preheating. The glower is a tiny white filament scarcely as thick as a common pin, platinum wires wound round the ends attach it to the supporting wires, which are of nickel, the junctions to the glower being covered with blobs of a substance similar to the glower body itself; below the glower is a triangular piece of unglazed biscuit porcelain, upon which is wound a fine platinum wire called the "steadying" resistance, connected in series with the glower, which has a tendency to run to excessive temperatures, and by reason of its rather high negative temperature coefficient renders such resistance necessary. The porcelain is hollowed out on each of the three sides, so that the platinum, which has a large positive temperature coefficient, rests only on the edges of the triangle. In the earlier forms it was found that the flat surfaces conducted off the heat of the platinum, and it took time to heat up the porcelain, and therefore it would not act as an automatic regulator and increase its resistance properly and quickly. The nickel supporting wires already referred to pass through the triangular piece of porcelain, terminating in eye pieces which engage the hook connections in the base of the lamp. Thus the glower and steadying resistance and their supports represent the renewable portion of the lamp, or, as it is called, the "replacement piece."

In Berlin and other places iron wire was extensively employed owing to its peculiar properties, and in order to prevent oxidation and make it operate successfully it was employed in an atmosphere of hydrogen gas. Although I saw many lamps employing this iron resistance, the tendency abroad now seems to be to do away with its use, and employ platinum or some special alloy instead.

In Göttingen—which, by the way, is not only the home of the inventor of the Nernst lamp, but enjoys the additional distinction of being the first place in which the Nernst lamp was commercially used (they claimed to have 300 in use)—I found a hotel in which lamps had been employed of the type heated with an alcohol torch; their use had been discontinued owing to the annoyance caused each time they were lighted. There is also an element of danger from fire in this type of open lamp, and they cannot be placed where subjected to a strong draught. Remarkable as it may seem, here is an electric light which not only may be lighted with a match, but which may also be blown out by a breath of wind. This type of lamp is much more apt to be broken. It would, of course, be unsuitable for use in mines, or in certain places where the carbon incandescent lamp can be used. The self-igniting lamp is naturally more complicated and more expensive, but it is self-evident that it is the lamp which must be used as a rule.

To explain the operation of the automatic or self-lighting type of lamp, when the current is first turned on, the heating coil is alone in circuit, as the glower, steadying resistance, and cut-out magnet, which are all in series, form a shunt around it of infinite resistance; the current passing through the heating coil soon makes it red hot. The glower or filament of refractory material is heated by radiation and convection from the coil, until its resistance lowers sufficiently for it to become a conductor of electricity. The moment this happens the current also passes through the tiny electro-magnet inside of the lamp base which is in series with the glower, and which, in attracting its armature to it, opens the circuit of the heating coil, leaving the filament or glower only in circuit with its regulating or steadying resistance and the magnet winding. It takes approximately 10 seconds for the lamp to light up after the circuit has been closed, although I have frequently timed lamps where they have taken as high as 40 seconds to light up. It is stated that the glower of the Nernst lamp must be heated to 700° C. before it becomes a conductor of electricity. The "heater," as it is called, consists of a thin cylinder of porcelain, around which is wound a very fine platinum wire, perhaps ·03 to ·04 mm. in diameter. The cylinder is then dipped in liquid porcelain, and after drying is bent in a spiral form by wrapping it around a rod while it is being heated by means of a blow-torch. There are usually from five to seven turns in this spiral.

The perishable portions of the Nernst lamp, *i.e.*, its glower, the heater and resistance—are constructed so as to be easily detached, as in the case of the non-automatic type of lamp, and can be replaced at from one-quarter to one-third of the price of the lamp, so that while the original cost of the lamps is greater than the carbon lamps the replacement cost is less. The electro-magnet will, of course, last indefinitely. In the replacement piece of the London

company's lamp, a compression-spring contact is used for one connection in conjunction with two eye pieces of different lengths, which engage two hooks in the lamp base, one long and one short; this makes it impossible to wrongly connect up the lamps.

In the German type of Nernst lamp the glower is placed in the centre of the heating coil. In the London company's type the heating coil is placed below the glower or filament; in others it is in the centre of the spiral, as in the German type.

The London company were for a long time puzzled in their endeavours to get rid of the buzzing noise of the cut-out magnet when operating upon alternating current circuits. It was finally found to be due to the air confined back of the armature, by reason of the form they employed; by cutting the iron away a trifle, this was entirely obviated.

The company is now standardising lamps for 8, 16, 32 and higher candle-power for circuits of 100 volts and upwards.

The 220-volt lamps are usually made of 25, 50 and 100 C.P., although I saw some at Ganz & Co.'s works at Buda-Pesth and elsewhere of as high as 160 C.P., which were being tested experimentally.

(To be continued.)

THE NATIONAL TELEPHONE COMPANY'S STAFF DINNER.

THE eighth annual dinner of this company was held on Friday last at the Trocadero Restaurant; Mr. W. E. L. Gaine, the general manager, presided, while among those present were Lord Kelvin, Sir Cuthbert Quilter, M.P., Sir Albert Rollit, M.P., Mr. W. Forbes, Mr. Dane Sinclair (chief engineer), Mr. A. Anns (secretary), and a large number of members of the staff, totalling over 200.

After the toast of "The King," the chairman read a letter from Mr. J. S. Forbes, regretting that the state of his health precluded his attendance; Lord Harris also, as happened last year, was prevented from attending by his Yeomanry duties. The chairman then proposed "The National Telephone Company" and gave the following statistics:—Last year the number of exchanges in operation was 968; now it was 999, and in another week would be 1,000. During the year, 29,221 subscribers were added, against 21,000 in the previous year, bringing up the total to 205,000 subscribers, as compared with 176,000. No less than 712 million messages were transmitted in the course of the year, showing an increase of 15·3 per cent., while the Post Office only transmitted 90 million telegrams, with an increase of 2·88 per cent. In spite of the threatened competition in Glasgow, the company had never had a more prosperous year in that city. As for the approaching competition in London, the real question to be decided was—who could serve the public best? It might prove to be beneficial both to the company and to the public. In any case, the company was not alarmed, feeling confident that Parliament would recognise the public value of the company's service.

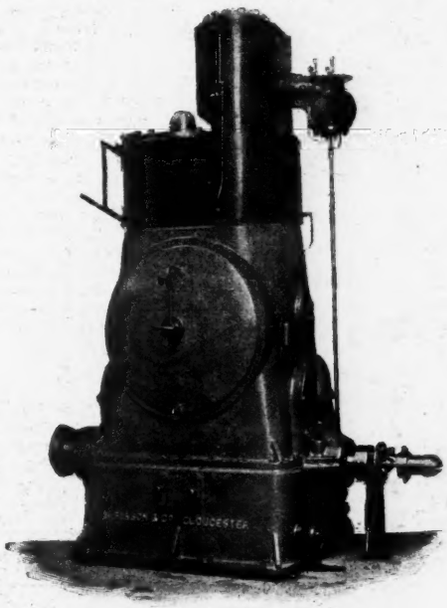
Replying for the company, Sir Cuthbert Quilter said that the company's present troubles were nothing compared with those of its infancy, when, at one period, the board of directors used to sit *every day!* The Government, instead of treating the company in a fair and businesslike way, was trying to kill "the goose that laid the golden eggs," and was pouring the public money into the subsoil of the streets. In spite of the unwise policy of the Government, however, he had no fear for the future, so long as the management was sound—it was never better—and the staff earnest.

Mr. C. M. Bailey then proposed "The Guests." In reply, Lord Kelvin pointed out that all subscribers to the Post Office telephone system would be compelled to get into touch with the National Telephone Company's subscribers. He thought the Government would correct the mistake which they were making, in the future. In the meantime, there was nowhere in the world to be found better appliances than those of the company, which would welcome every improvement, from whatever source. Sir Albert Rollit also replied, and paid high compliments to Lord Kelvin and to the staff of the company.

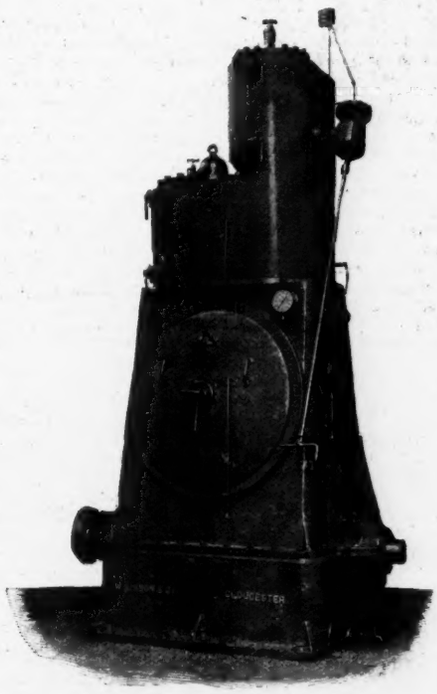
The proceedings were interspersed with a capital programme of vocal and instrumental music, and the function was, as usual, highly successful and enjoyable.

SISSON'S HIGH SPEED ENGINE.

THE high speed engine here illustrated is made by Messrs. W. Sisson & Co., of Gloucester, and possesses many points of interest that are evidently the result of carefully matured ideas. To begin with, the engine is compound and double-acting, with the cranks of the high and low pressure cylinders placed opposite. The distance apart of the two crank centres is less than the combined radii of the two cylinders. This desirable end is secured by a novel arrangement of cylinders. The high pressure cylinder is placed above the low pressure cylinder in such a way that the high pressure piston-rod comes down just outside the body of the low pressure cylinder, and in this way the cylinder centre lines are brought very closely together, and the moment or couple resulting from the moving parts is reduced to a minimum. At the same time, the high pressure cylinder is sufficiently above the top of the low pressure to permit of the low pressure cover being lifted, and the piston taken out easily without dismantling any other parts. The high pressure piston-rod comes through a long bush, and no part of the rod that enters the cylinder ever becomes exposed to external cooling effects; there is a chamber in the gland or bush which is drained, and serves as a detector of any steam leakage, the drain-pipe being brought to the outside. The engine is of

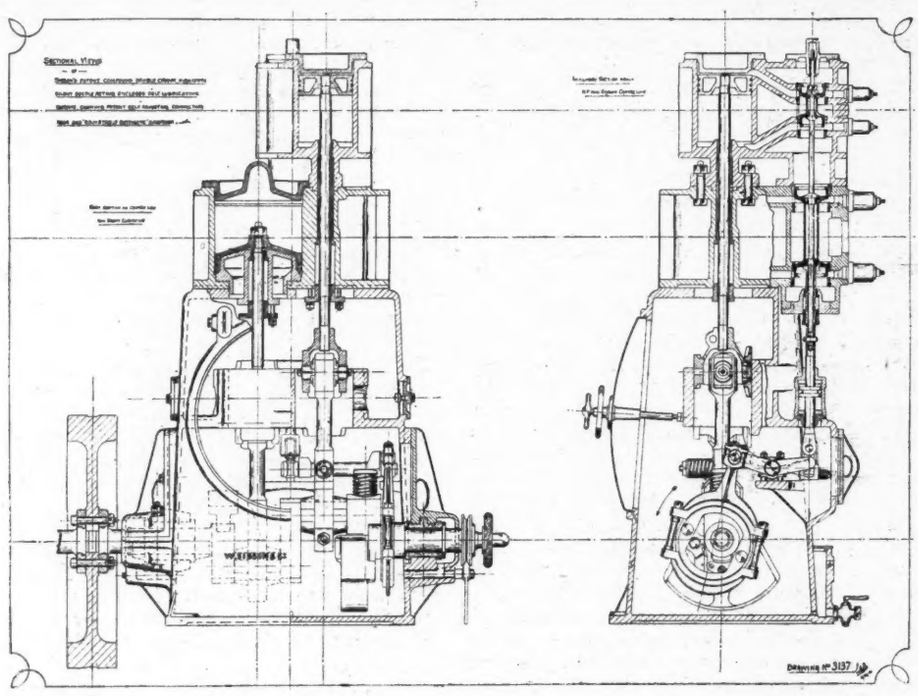


enclosed type, with splash lubrication; but, as shown in the illustration, the door is of great size. It is pressed out of steel sheet, with an abutting edge that comes against a flange in the framing or casing, round which there is a groove drained back to the chamber by holes at the lower part. The device is very successful, and not the slightest trace of oil is externally visible. The valves, of piston type, are in one line driven from a single



eccentric through a rocking lever as shown. Steam to the high-pressure cylinder is taken in at the inside of the valve, and for the low-pressure cylinder, steam is admitted over the outside edges. By this system there is no cold exhaust jacket round the first cylinder, and the low-pressure exhaust also is carried directly away without an encircling jacket. The inertia of the string of valves is counteracted by a dash pot or air cushion of double-end type so as to act at each end of the valve stroke. The eccentric rod is placed at the angle shown in order to shorten the rocking levers and to

give quick decrease and final extinction of lead when the governor is at the no-load position. The cross-head guides are bored, and are fitted with liberal slippers on the crossheads. The governor is of the fly-wheel type, carried by a frame fixed to the high-pressure crank web, to which the weights of the governor act as counter balance. The two pistons and their respective rods are of equal weight, thereby balancing each other, the long high pressure rod helping to make the balance without too much weight being put into the high pressure piston. By means of a taper key and spring the connecting rod brasses are self-adjusting. A special



feature of the engine is its crankshaft. The engine illustrated is of 60 B.H.P. It has cylinders 6½ and 10½ in. diameter by 6 in. stroke. The speed is 600 revolutions per minute. The diameter of the crank pins is 3¼ in., and the bearings are very long and are arranged to be well flooded with oil, which freely circulates and runs back into the crank chamber. We think such a diameter of crankshaft for this size of engine is quite unprecedented. Not that we think it is too big, but it is a recognition of what we have frequently urged, that high speed engine shafts require to be of great size, and that they have usually been made too small. As an example of the sort of crankshafts employed by Messrs. Sisson, we may cite their 500-H.P. engine with cylinders 16 in. and 26 in. by 15 in. stroke. The cylinder centres are 18 in. apart and the crank pins and main journal are 8 in. diameter. The speed is 300 revolutions per minute. A peculiarity of these crankshafts is that they are *not* made of mild steel of about 30 tons tenacity.

Experience has taught Mr. W. Sisson that the special desideratum of a crankshaft is stiffness and good close texture, and this he secures by employing steel of 40 and even 45 tons tenacity. The result is, first, that the shafts will finish more truly cylindrical in the lathe, and that they will spring less when at work, and will wear less also and maintain a truly circular shape better and longer than can be the case with soft steel.

Another peculiarity is the fly-wheel, which has no boss, but has a central plate, which is faced true on both sides and bolted between the flanges of the shaft coupling, as shown in the illustration.

The indicator gear is a lever driven by the crosshead and projecting through the upper part of the standard or casing, both instruments being driven by a very short cord, as they should be.

The caps of the crankshaft bearings are removable with a part of the end of the casing, and the crankshaft can be removed endwise through the opening thus made. We have seen these engines at work and under construction, and can speak as well to their excellent running and the very satisfactory character of the material and workmanship.

Mr. Sisson is a strong believer in the double acting form of engine, because for a given size this gives double the power of a single acting engine, and can be better lubricated, oil finding its way to the bearings much more readily. Perfectly silent running is obtained with self-adjusting connecting rods, which in Mr. Sisson's arrangement will still give some yield in case of accidental heating.

There is a special advantage in the Sisson engine in the extraordinary closeness of the cylinders, for one piston load is largely carried by the opposite piston load, the result being that the crankshaft bearings are only called upon to carry less than one-third of the piston load. The rocking movement is made a minimum, and the balancing requires little more than the essential parts of the engine itself. With the higher rates of revolution there is an air cushion cylinder to check the inertia of the line of valves.

By the use of the long neck bush to the high pressure cylinder the heated rod never touches the packing, and high superheat is thus rendered practicable. The piston valves work in seats of a hard close grained nickel iron cast alloy, and owing to the way the valves take steam the valve rod gland is only exposed to receiver steam.

Owing to the fact that the high pressure valve admission is "blind" to steam at the no load position of the governor, the engine will not race when all load is thrown off suddenly, though it may be exhausting into a good vacuum. This feature renders the engine suitable for tramway purposes, or any purpose where loads are widely variable, while the fact of both cylinders having their valves on the same line makes the low pressure cut-off vary in parallel with that of the high pressure, a point of importance in traction work, because it serves to prevent the engine being exhausted of all its contained steam. The receiver remains under pressure, and a sudden addition of load to an unloaded engine causes the valves to open wide; while one admits boiler steam to the high-pressure cylinder, the other admits receiver steam to the low-pressure cylinder. The receiver, in fact, checks the engine when it would race, and finds power to keep it to full speed when suddenly loaded. These engines are made either as two-cylinder side-by-side compound, as two-crank triple or four-crank compound, and as four-crank quadruple in the larger sizes.

The engines are also made to govern by automatic expansion down to a certain point, and below that point by throttling. We should add that the self-adjustment of the connecting rods is effected by means of a column strut in the hollow interior of the bored-out connecting rods, with a transverse wedge of carefully determined angle, held up by a coiled spring in compression, so arranged that even should the spring break it could not get away, and would continue to exert its pull on the wedge sufficiently to avoid more than perhaps a slight sound. We consider this to be one of the best worked out high speed engines we have yet seen.

ELECTRIC VAPOUR LAMPS.

CONSIDERABLE interest has been created among electricians and physicists by the fact that in April last an American inventor exhibited at Columbia University, before the American Institution of Electrical Engineers, a number of electric glow lamps, in which the incandescent substance, instead of being a carbon filament, was a column of rarefied vapour. It has, of course, been known for a long time that a rarefied gas in a sealed tube can be made to glow by means of an electrodeless discharge or by currents of high frequency, and of late Mr. Nikola Tesla has declared that he has now made lamps which can, by such means, be made to glow so

brightly as to be used for house lighting. But the incandescence in the present case is of quite a different kind from that produced in a Tesla tube or in a Geissler tube. It is again different from the ordinary electric arc produced with mercury electrodes in mercury vapour, though probably the difference in this case is one rather of degree than of kind. The incandescence in these new lamps is produced by direct currents under low or moderate electromotive force. The object of the inventor, Mr. P. Cooper Hewitt, is to produce light by the conversion of electrical energy into luminous radiations with the smallest expenditure of energy in heat. The temperature of the filament in an ordinary incandescent lamp is very high, and therefore denotes so much waste of energy. With a gas, however, which can be made to become and remain luminous, it is possible to secure a much smaller waste through rise of temperature, and the inventor claims to have discovered that certain gases and vapours can be made to act as conductors of the electric current, and to behave exactly like metallic conductors. From the short note which has been published by Mr. Cooper Hewitt to explain his recent demonstration, it is impossible, except from the drawings, to gain much information on the theory and construction of the lamp; but we do get some information from the specification of the patent No. 11,562, 1900, which he took out for these lamps in the summer of last year, and which seems to have escaped notice so far. The vapour preferably used by the inventor is mercury vapour, and this was the substance used in all the lamps shown at the recent demonstration. The cathode in this case is mercury and the anode iron. We are told, however, in the specification that "nitrogen and other gases" may be used as light producers.

The theory of the lamp is briefly this. For every gas there is a certain density for which its electrical resistance is a minimum. Any increase or diminution of this density increases the resistance, and the conductivity of different gases at this point of minimum resistance varies greatly. Any chosen gas, therefore, may be made to assume the proper electrical resistance so as to become incandescent when a given current is passed through it, and thus to produce a commercially useful light. The electromotive force used must be great enough to overcome a practical length of gas or vapour at the density of minimum resistance. The current consumed is governed by the density of the gas and the length and cross-section of the path through the vapour. Mercury vapour is found to be the most suitable, as it has good light efficiency and also a low boiling point. The extraordinary resemblance of its behaviour to that of an ordinary metallic conductor is seen at once by reference to the following figures, taken from one of the experiments shown at the demonstration to which we have referred. When the proper density to produce incandescence with a given current had been found, these readings were taken:—

Length of tube.	Diameter.	Voltage required.
54-in.	⅜-in.	90
27 „	¼ „	46
54 „	1½ „	54

The voltage of 54 in the last experiment is considered by Mr. Hewitt to be due to the presence of impurities in the wide tube.

It is somewhat remarkable that this conductivity of rarefied mercury vapour should not have been discovered before, as of recent years a vast amount of research on the electrical properties of rarefied gases has been made. It was commonly considered that a rarefied gas was an exceedingly bad conductor, for such experiments as those of Hittorf, De la Rue and Hugo Müller showed that when a tube, provided with electrodes and filled with such a gas, was placed in a circuit round which there was a given electromotive force, the intensity of the current fell to such an extent as would have been produced by a resistance of several million ohms. Prof. J. J. Thomson, however, showed that this apparent resistance was mainly due to the difficulty which the discharge has in passing from the electrodes into the gas, and that if the circuit is made to consist entirely of the rarefied gas, the gas is seen to be a remarkably good conductor of electricity. No similar experiments seem to have been made with metallic vapours at low pressures, although J. J. Thomson found that at ordinary atmospheric pressure mercury vapour is a bad conductor, while sodium vapour is a very good conductor.

We have seen that the inventor of these new lamps has stated that "nitrogen and other gases" may be used instead of mercury vapour. We are not told what the "other gases" are, but it would be interesting to know whether the inventor has really succeeded in making a lamp in which nitrogen is used; for if so, it is evident that the very high resistance usually found between an electrode and a rarefied gas must in this case be absent. That there is a very considerable resistance at the negative electrode, even with mercury vapour, is made clear by one of Mr. Hewitt's experiments, in which he inserted a third electrode of mercury in his tube at a point one-third of the length of the tube from the anode, and connected this electrode with the cathode by a negligible resistance. Although the measured electromotive force between these two electrodes was 44 volts, the current registered through the shunt was only 0·02 ampere, thus showing a resistance of over 2,000 ohms in the circuit. Such a resistance, however, is very little compared with the millions of ohms found in the experiments to which we have referred; but naturally the resistance between a metal and its own vapour is very different from that between a gas and a metallic electrode. The specification of Mr. Hewitt's patent is very unsatisfactory on this point of the resistance between a gas and an electrode with which it is in contact, for we are told that care is generally taken "to make the resistance of the conducting gas or vapour relatively greater than the resistance between the electrodes and the gas or vapour path." Such a statement seems quite contrary to J. J. Thomson's discovery that the resistance of the rarefied gas itself is very small indeed compared with that between the electrodes and the gas. It is just possible that the incandescence in this new lamp may prove to be due to a large extent to actual metallic conduction by the mercury vapour along the sides of the tube; for the inventor himself tells us that when currents of considerable quantity are used, the current tends to pass round to the back of the cathode and to fuse the leading-in conductors and disintegrate the glass supporting them. To avoid this he protects the electrodes by exposing only those parts by which the current is intended to enter, and in the mercury lamp this is done by using liquid mercury as the cathode. This passing of the current to the back of the cathode naturally suggests conduction along the sides of the tube. It is to be hoped that, in the light of Mr. Hewitt's discovery, extensive experiments may be made with many gases and metallic vapours, as they could not fail to be instructive, and might lead to valuable discoveries in the realm of molecular physics.

Considered as a commercial article rather than as a piece of laboratory apparatus, Mr. Hewitt's lamp gives promise, but is, as yet, unsatisfactory. It is already seen to be a lamp of high efficiency, as reference to the following tables will show:—

—	Length of tube.	Diameter.	Watts.	Candle-power.	Watts per candle.
I.	54¼-in.	1-in.	675	1,050	0·65
			510	920	0·53
			365	840	0·43
			223	700	0·32
II.	35½-in.	⅝-in.	490	740	0·62
			325	565	0·57
			150	400	0·38
III.	32¼-in.	¾-in.	696	770	0·90
			490	630	0·78
			365	590	0·63
			260	530	0·50
			185	455	0·40
			165	420	0·39
IV.	54-in.	1¼-in.	615	755	0·81
			595	710	0·55
			310	650	0·47
			230	600	0·38

With the large tube a pressure of 100 volts, and current of 7 amperes, gave a light of 1,500 candles.

The objection to the lamp in its present form is not on the ground of want of efficiency, but the nature of its light. If no other vapour than mercury vapour can be found to give good results, then we fear it will not prove suitable for commercial use, for the colour of the light makes it impracticable. The spectrum of mercury has practically no red lines, and the light of this lamp is correspondingly lacking in the red part of ordinary light. The inventor himself points out in his specification that in choosing a gas it is most important to consider its spectrum, and that "the material for the vapour or gas must be determined by the special conditions and requirements of each case." That is a very general statement and does not help us at all out of the difficulty; and, indeed, as the inventor himself seems so far to have confined himself to mercury vapour, it is probable that he has not yet been able to solve it. If mercury vapour is to be retained, steps must be taken to discover some substance which may be added to it to supply the red rays, and which will not have a chemical action on the mercury vapour nor an injurious action on the tube.

In this connection it is interesting to notice that only two months later than Mr. Hewitt's patent, another patent was taken out in England at the instance of the General Electric Company, of U.S.A., for commercial electric glow lamps, in which the light is produced by a mercury arc with various substances added to the vapour to give any desired colour to the light (see Patent No. 14,121, 1900.) One method employed is to add the modifying conducting vapours in a chemically inert condition and preferably in the "ionised" state, that is, as free atoms co-existing with free atoms of some other substance combining with the conducting vapours at ordinary temperatures, but at complete or partial dissociation at the temperature of the mercury arc. Iodine is found to be the best substance, and thus to produce a red light the surface of the mercury is covered with anhydrous lithium iodide; for white light, a mixture of iodides of lithium and sodium; for blue light, iodide of indium; for yellow light, iodide of sodium; and so on. Where the enclosure is not perfectly air tight, chemical action is not prevented but is regulated so as to prevent the transparency or translucency of the enclosure from being destroyed. This is done by using salts of silica acids, especially meta-silicate of lithium, $Si\,O_3\,Li_2$. An exchange of bases takes place betweeen the silicate and the hard glass of the envelope, but the silica salts thus formed on the inner surface of the tube are transparent, or at least translucent, and the only effect is to give a frosted appearance to the glass. Perhaps some of these substances might be tried in Mr. Hewitt's lamp with good results; but whether the lamp eventually becomes a commercial article or not, the investigation of the behaviour of these vapours should add to our knowledge of molecular physics.

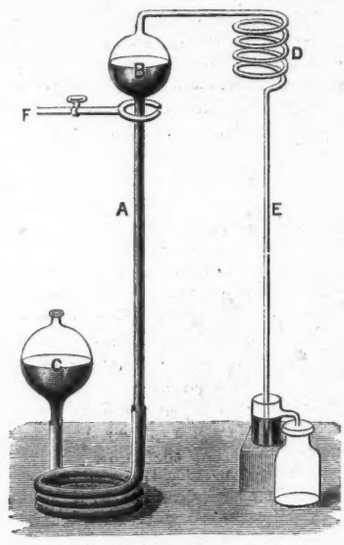
MR. P. COOPER HEWITT'S NEW MERCURY VAPOUR LAMP.

By LEGH S. POWELL.

I understand that an article on Mr. Hewitt's new and apparently epoch-making lamp is shortly to be published in your Journal. It will be of interest, perhaps, if I supplement your article with an account of an experiment I made with a former colleague years ago when carrying on incandescent lamp manufacture at the Brush Company. In conducting this experiment, the object of which was the automatic distillation of mercury in vacuo, we observed some novel and brilliant luminous effects.

The accompanying drawing represents the apparatus we devised and fitted up. A is a barometer tube terminating at the upper end in a bulb, B. The lower end is connected by a flexible rubber tube to a reservoir, C, containing the mercury to be distilled. To the bulb, B, is joined one end of a glass spiral made of quill tubing, D, the other end being attached to a Sprengel shaft, E, dipping into mercury. Finally, below the bulb, B, is placed a ring burner, F.

In order to start the distillation, it is necessary to raise the reservoir, C, until the air in B is driven out and mercury commences to flow into the glass spiral, after which it is quickly lowered until the bulb, B, becomes about half filled



with mercury. The effect of this operation is to create a vacuum in the glass spiral and bulb B. If the gas is now lighted, mercury vapour will, in due course, be formed in the bulb, and will condense in the glass spiral and flow through the Sprengel shaft, carrying with it any gas remaining in the apparatus.

On starting the distillation for the first time, we were greatly surprised and interested to notice that as soon as sufficient mercury globules had collected in the spiral to cause a drop to flow and collect other globules in its path, a brilliant streak of greenish light was apparent along the track of the rolling mercury. When distillation was proceeding briskly the greenish streaks of light appeared in one or other part of the spiral in quick succession. The actual amount of light produced was really small, but in the darkened room in which the experiment was made, it had a striking and very pretty effect. The conclusion we came to as to the cause of the light was, that by the rolling of the mercury static electricity is developed; which, in the presence of the surrounding heated mercury vapour, gives rise to momentary Geissler tube effects. If this explanation be correct, the possibility of very great economy in illuminating power would be indicated, when it is considered how very little energy can be produced by the flow of the mercury, and be converted into electricity. It is possible, however, that the energy which produces the light may, in part, come from an electrically charged surrounding vapour, and thus be derived directly from the coal gas.

At the time of making our apparatus we were unaware of a somewhat similar apparatus previously designed, I believe, by Dr. Clark. In Dr. Clark's apparatus, which is better adapted for the object in view than our own, the tube, in which condensation takes place, is carried down inside the barometer feed pipe, and being thus invisible, excepting in the upper part of the bulb where it is in contact with the mercury vapour, no luminous effects can be seen.

At the date of our experiment—about 1885—I had no time to investigate the phenomena, but at subsequent periods I have seriously sought to make further experiments in this direction, and in 1888 or the following year went so far as to get a glass-blower to make me a number of specially constructed tubes. I failed, however, in my endeavours to get other requisite means placed at my disposal.

In conclusion, I should like to congratulate Mr. Hewitt on the success he has already achieved, and to express my hope that he and others working on the same lines will

succeed in producing a thoroughly practical and efficient lamp.

The attention of those interested in this subject may be called to a patent filed in August, 1900, by the General Electric Company, New York, of which the following is an abstract recently published by *Engineering*:—

14,121. G. C. Marks, London. (General Electric Company, Schenectady, N.Y., U.S.A.) Electrically producing light. [15 figs.] August 7th, 1900.—In this specification, terminating with 38 claims, are described many forms of apparatus in which light is electrically generated in vapour of mercury or of mixed substances, one of which is mercury. The efficiency is stated to be from three to five times that of the carbon arc lamp. One or both of the electrodes is metallic mercury, and the electric discharge is confined within a glass tube perhaps exhausted of air, and having a residual atmosphere of helium or some easily penetrable gas. When the lamp is working, the mercury is maintained at the boiling point, and a condensing chamber is therefore of value to take off excess of mercury vapour. Mercury vapour alone yielding a light of unsatisfactory colour there are introduced into the arc vessel other substances which vaporise at the temperature of the mercury arc and cause light of various or mingled colours to be produced. These substances (for example, iridium, lithium, sodium, thallium, &c.) are introduced in an ionised or combined state, so that they may not attack the glass, and preferably lie on the surface of the mercury. Lamps purporting to be practical are described, in which the distance between the electrodes is increased as the lamp lights up. (Accepted January 30th, 1901.)

THE GLASGOW EXHIBITION.

The Engineering Exhibits.

(*Continued from page* 861.)

The Machinery Hall.

The Electrical Company, Limited, of London, whose business covers a very wide class of machinery and apparatus for electrical work, have a good showing of motors and generators for direct and three-phase work, and measuring instruments, lamps (arc and incandescent), and many electric lighting and power fittings and accessories. Messrs. Rosling, Appleby & Fynn have specimens of the Fynn patent electric generators and motors for direct and alternating currents.

At the three-throw pump stand of Messrs. Andrew Barclay, and Co., a 35-B.H.P. Lancashire Dynamo and Motor Co.'s motor does service. Mr. A. Hafter shows his steam fittings, Messrs. J. Macdonald & Son their interwoven metallic flexible tubing, and among a variety of things exhibited by Messrs. J. F. Pease & Co. are their electric cable boxes. Messrs. Barr & Stroud have exhibited a number of range-finders for naval, fortress and field mounting, and electric transmitters and receivers for use in connection therewith; also their high vacuum pump for incandescent lamp and X-ray tubes, as employed by the Ediswan Company. Their electric clocks, of which 14 are fixed in the Grand Avenue, Machinery Hall and boiler house, are driven from this stand. Messrs. John Macdonald and Co., whose Achilles turbines are being employed for driving electrical installations in Ireland, Russia, and elsewhere, have an exhibit of these water-wheels. Flexible metallic tubing in bronze and steel is shown by the United Flexible Metallic Tubing Company, the Hercules turbine pumps and so forth by Messrs. J. Turnbull, Jun., & Sons; gauges, indicators, lubricators, and many other instruments of the same class are to be seen at Messrs. Schaffer & Budenberg's. A "Niclausse" water-tube boiler and parts is placed on view by Messrs. Willans & Robinson. Corrugated metallic packing is shown by Messrs. Newton & Nicholson, a big exhibit of all kinds of Delta metal by the Delta Metal Company, steam fittings by Messrs. A. Welsh & Co., governors by Aspinall's Patent Governor Company, axle boxes by the Indestructible Rolled Steel Axle Box Company, and Galloway tubes and model of boiler and fittings by the firm of Galloways, Limited.

Steel castings, rails and so forth, are exhibited by a number of leading British manufacturers, and near at hand is an interesting show conducted by the British Griffin Chilled Iron and Steel Company, Limited, illustrating, among other things, chilled tramway wheels manufactured on the Griffin process. One of those to be seen is a hollow-spoke wheel, which has run continuously on the Liverpool Overhead Railway for a distance of 73,665 miles without being touched, and there are also two which have done service for 60,000 miles on the Dublin United Tramways. It should be mentioned that 30,000 miles is the average guarantee. A test bar is shown here supporting a pyramid of wheels weighing over a ton.

The patent improved Thorneycroft water-tube boiler, and a Cross's patent four-crank engine of 140 I.H.P. are represented at the space taken by Messrs. Simpson, Strickland & Co., Limited, of Dartmouth, who also show a small 2-H.P. engine and dynamo for launch work. We understand that their compound engines for electric lighting plant may shortly become better known among electrical engineers. Messrs. Ross & Duncan, of Govan, exhibit their marine and launch engines in operation. Messrs. Walter Macfarlane & Co., of Possilpark, whose standards and poles find a place in lighting and tramway systems, have a showing of their ornamental iron work. Poles for similar purposes and also for telegraph work are to be found at Messrs. Stewart & Menzies' stand of tubes, fittings, &c.

The exhibit of Messrs. Dick, Kerr & Co. comprises specimens of the beautiful electric trolley cars which everybody admires, and the large electric generating sets, motors and electric tramway equipments which are manufactured at the two modern works at Preston, Lancashire, which are now doing so important a business in British electrical engineering. They show two representative tramcars, one of which is a topseat four-wheel car, and the other a combination bogie; a 500-KW. direct current generator (100 revolutions); switchboard apparatus; a full line of traction motors up to 100 H.P.; controllers and detail parts; also special track work.

We cannot forbear at this point a reference to several excellent exhibits of British made steam locomotives, which stand out boldly as a monument to the substantial construction and beautiful design and finish which give these so majestic a bearing, and make them a credit to the British manufacturers, Messrs. Dubs, Messrs. Sharp, Stewarts, and Messrs. Neilson, Reid, and Messrs. Barclay, whose works they are.

Quite recently notices have appeared in the columns of the Electrical Review regarding the British Electric Plant Company, Limited, which is building manufactories at Alloa, and some of the work executed by them is exciting a great deal of interest at a very practical exhibit of the proprietors of the *Glasgow Herald*, Messrs. George Outram & Co. The great printing and folding machine shown was made by Messrs. Hoe & Co., and it produces a 16-page newspaper at the rate of 24,000 per hour. It is fitted with a very complete electric motor driving equipment on the "Reducer" (Spence's patent) system of the British Electric Plant Company. The apparatus comprises a motor of 50 B.H.P., capable of developing a turning effort at starting equivalent to 100 H.P., which drives the machine direct through a flexible coupling. When going at full speed the motor runs about 400 revolutions per minute, while for preparation of the printing rolls and for leading in the paper a speed not exceeding $\frac{1}{25}$th of this, or 16 revolutions, is demanded. This requirement of a dead-slow speed, which must be constantly maintained without variation, is met by the employment of a motor-generator transformer, the reducer, whose function is to reduce the pressure of supply from 500 volts in this case to a lower pressure corresponding to that of the slow speed. The transformer has a capacity of about 13 H.P., and at the slow speed named this enables the press motor to turn with an effort equivalent to 100 H.P. at its normal full speed. The controller is of special design, and by the continuous motion of a hand-wheel all the necessary motions for starting, regulating, and stopping the machine are performed, the arrangement being such that each follows in its proper sequence. Another feature is the provision of a reversing switch for enabling the motor to turn the machine backwards when wanted. Owing to the high velocity and to the great mass of machinery in motion, the inertia at full speed is very large, and considerable loss of time would occur were the motor merely switched off and allowed to slow down gradually. To prevent this, an electro-magnetic brake is provided, which comes into action automatically whenever the current fails or is switched off, and to further complete the effectiveness of control, a number of push-buttons are fixed at different positions on the machine, pressure on any one of which opens the cut-out and applies the brake. Thus any attendant noticing a breakage in the paper can promptly stop the machine and prevent waste.

Some printing machines, which are exhibited by Messrs. Aird and Coghill, are driven by electric motors lent by Messrs. J. H. Holmes and Co., who also lent the motor for driving an air-pump shown by the Edwards Air Pump Syndicate at the stand of Mr. C. Williamson Milne. At Mr. Milne's stand there is also an exhibit of the Davy arc lamp. The "Jackson-Menzing" arc lamps may be seen at Messrs. Bruce Peebles' stand.

Electric and other globes are shown by Mr. John Baird, and Messrs. Bagshawe show non-conducting materials, elevating and conveying machinery, and other things. "Lancaster" steam traps, pistons, metallic packings and steam dryers are shown by Messrs. Lancaster & Tonge, Limited, and feed water apparatus by the Harris Patent Feed Water Filters, Limited.

Direct coupled engines and generators and the well-known "Pallion" motors are exhibited by the Sunderland Forge and Engineering Company; also their electric winch.

The Anti-Friction Alloys, Limited, of London, show besides the unworked up ingots of their manufactures a number of pieces of machinery bearings actually lined with their metal. Many of these have been used and carry with them a record of long and useful service; others are new, but are shown to illustrate the application of the metal for their particular purposes. Among the specimens shown are a main bearing for large shaft, a cylinder neck bush solid Atlas tramcar bearings, and cast-iron car bearings lined Atlas.

The Tandem Smelting Syndicate shows its Tandem anti-friction metals, Babbitt metal, &c. Engine packings are among a variety of exhibits at the stand of the United States Metallic Packing Company, Limited, of Bradford.

Messrs. E. Green & Son's exhibit in the Machinery Hall show one of their patent economisers of a small size, suitable for one steam boiler. On this stand they show a 5-in. double-ram feed pump and 5-in. cylinder high pressure horizontal engine for economiser scraper driving, &c. They also show specimen castings. As stated by us last week, Messrs. Green have erected a special pavilion in the North Gardens, where they show a large economiser containing 192 tubes in three groups of 64 tubes each, coupled together by expansion elbows top and bottom, with the scraper gearing driven by a motor which is enclosed in a glass case on the

top of the economiser. The scraper mechanism on this economiser can be seen working. They also show a large size double-ram pump for feeding boilers and for fire purposes. We may add here that the same firm is further supplying two working economisers erected in conjunction with the boilers supplying the electric lighting power and driving power for the Exhibition. One economiser, fitted to the battery of four Lancashire boilers, contains 192 tubes in sections of eights, and is arranged in every way on their most modern principle. The economiser will contain nearly 2,000 square feet of heating surface. With the Davey-Paxman boilers, which are supplying the driving power for the electric lighting section, they are erecting an economiser of 120 pipes in sections of sixes, arranged in two groups, with spaces between and round the tubes so as to give access to all parts of the apparatus. This economiser will contain about 1,200 square feet of heating surface. Its scraper mechanism is driven from convenient shafting.

Messrs. Drysdale & Co., of Glasgow, have a stand at which, amongst other machines, they show in motion one 16-in. direct acting "Bon-accord" high-speed engine, and a four-pole dynamo of about 16 B.H.P., coupled direct. The engine is of their ordinary direct open double-acting type, fitted with crankshaft governor, and having all recent improvements, including automatic crank-pin bolts for taking up the wear of the crank-pin brass, and rendering the working of the engine practically noiseless. The dynamo is of Messrs. Mavor & Coulson's make, from their latest designs and patterns. The whole installation is neat and compact, and suitable for use on shipboard for lighting merchant steamers, private installations, &c. There is also shown on the same stand a small centrifugal pump of the Series type, all specially made of aluminium. This pump is coupled direct, and driven by a small 1-H.P. Lundell motor. In addition, they are exhibiting at work one of their 5-in. direct acting centrifugal pumping engines; also one of their direct acting fan engines for forced draught and ventilating purposes.

The firm of L. Sterne & Co., Limited, of Glasgow, gives a very full display of the De La Vergne refrigerating machines of the "pony" type. They also show a large number of their emery grinding machines, a pyramid of emery wheels, and a number of spiral and safety valve springs, as supplied to engineering establishments and locomotive builders.

The Sturtevant Engineering Company, Limited, have an important exhibit of direct coupled generating sets, direct coupled engines and blowers, direct coupled electric motors and blowers, also a representative show of their Cutler-Hammer motor controlling apparatus.

An exhibit by Messrs. W. C. Martin & Co., of Glasgow, shows combined steam-driven generators, motors, electric fans, and electrical appliances for ship work. The Sun Fan Company has a showing of its fans for various purposes, driven by electric motors either by means of belt or direct. Messrs. J. Gibbs & Son, of Liverpool, have also a stand where their patent electric fans with dust-proof motors are operating, and their new patent motor starting and regulating switches may be seen. A special exhibit of this class is that of the James Keith & Blackman Company, where at night time by a combination of different systems of illumination, together with a water motor in operation, an effect is produced which makes the exhibit stand out very prominently among its fellows, and attracts a crowd of spectators.

Blowers, pumps, and fans, both steam and electrically driven, are exhibited by Messrs. Thwaites Bros., of Bradford. The dynamo used here is by Mosling, Appleby & Fynn, and Ellis & Creighton's patent reducing gear is also in evidence. Mr. Thomas Brierly, of Oldham, shows blowers and fans, and Mr. John Cochrane, who has a Corliss engine driving a length of Exhibition shafting, also exhibits his pumping machines and steam hammers. Electric and other pumps are shown by Messrs. A. & P. Steven, of Glasgow.

A variety of steam auxiliary fittings and apparatus is exhibited by Messrs. Royles, Limited, and it includes traps, dryers, feed heaters, condensers, &c. An exhibit of a similar character, comprising patent filters, heaters, evaporators, &c., is to be found at Messrs. Davie & Horne's stand. The Pulsometer Engineering Company, whose pumping machinery is being more extensively employed than ever, have a good showing of their pumps, filters, sirens, and other special lines.

Messrs. Alexander Shanks & Son, Limited, of Arbroath, show a compound vertical high speed open type engine, combined with a dynamo by the Newton Electrical Works, suitable for ship lighting. The engines are made open and enclosed, and for direct or independent coupling with dynamo shaft or belting.

A good exhibit is arranged by Messrs. Mavor & Coulson, but at the moment all we can do is to indicate the wide field covered, by stating that electrical and other pumps, drilling and coal-cutting machines, direct coupled steam-driven generators, electric motors, switchboards, electrical apparatus and accessories for lighting and power work, and the firm's concentric wiring system are all well shown. Messrs. John M'Dowall & Sons, of Johnstone, have a number of wood-working machines on view, five of them being driven by means of Pallion motors supplied by the Sunderland Forge Company, of which there is a 4 H.P. running at 1,200 r.p.m., and a 15 H.P. running at 850 r.p.m.

We now come to a very varied exhibit by Messrs. Veritys, Limited. Good fortune has given the firm so much work in connection with the electrical fitting of other stands in the Machinery Hall, that when we visited their own stand it had not been possible to get things together, and in that apple-pie order which they desired, but this difficulty has, no doubt, been overcome by this time. Dynamos and motors for electric lighting and power work, and fans, and electric fittings abound. The Cropper-Charlton printing press is shown driven off a friction wheel by means of a small electric motor. Mr. Claud Hamilton is also an exhibitor of electric lighting, power and heating apparatus, including motors, search light, fans, dynamos, switchboards, &c.

A very special exhibit now demands attention. We refer to that of Messrs. D. Stewart & Co., Limited, of Glasgow, whose engines have recently been brought out into greater prominence for electrical work on account of their use in connection with the large Kalgoorlie electric power and lighting plant, and in connection with the Glasgow electric tramway system. Anyone making a stop at Stewart's stand should not fail to give a glance at the globe upon which, by means of beads, is indicated the number of engines of their manufacture which are doing service in Australia, Africa, and various other Colonial and foreign parts. Perhaps the most important item in the firm's exhibit, and one which, we have no doubt, will decide many an engineer to wait and conduct investigations, is MacCallum's patent internal combustion engine, which produces power by the direct combustion of coal without the employment of steam boilers. At the time of our call the engine was not running, but we understand that it is intended throughout the remainder of the Exhibition period to have it in operation for a few hours daily. The set is 100 H.P. at 150 revolutions. Electrically driven centrifugal machines and refrigerators are among the other exhibits of Messrs. Duncan Stewart & Co.

The Lahmeyer Electrical Company, Limited, which has recently begun more actively to push its manufactures in this country through the medium of a London office, has an exhibit of the Frankfort electric generators and motors, and also shows enclosed arcs for direct and alternating current circuits.

A stand of very large proportions is under the care of Messrs. Clarke, Chapman & Co., Limited, of Gateshead-on-Tyne. Amongst their several specialities there is a good exhibit of steam pumps consisting of single cylinder type of slow speed direct-acting boiler feed pump, "Woodeson's patent," and one pair of similar independent pumps fixed to cast-iron feed tank and fitted with automatic controlling gear, vertical duplex type of high pressure feed pump, and horizontal duplex low service, cargo or ballast pump. We understand that during the past few years the single cylinder direct acting type of boiler feed pump has grown greatly in favour with steam users, both for marine and general power installations. Windlasses, winches, capstans, and work of this kind for which the firm have long been well known are prominently shown on this exceedingly interesting stand. The electrical exhibits include a combined plant (200 16-C.P. lamps) suitable for ship use. The speed is 300 r.p.m., and the E.M.F. 65 volts. The machine will be running during the Exhibition, and will supply current to the projector on the conning tower of the stand, also several smaller size projectors. There is also a similar plant, but fitted with a compound engine (250 lamps of 16 C.P.) running at 350 r.p.m. Both of these are types of plant supplied very largely for use on shipboard, a class of work of which Clarke, Chapman's make a speciality. There is also a large compound engine and dynamo (direct coupled) which consists of a patent high-speed engine, the design of Mr. J. W. Restler, the chief engineer of the Vauxhall Water Company. It is of the single acting type, and the plant exhibited will supply about 700 16-C.P. lamps. The engine has an enclosed governor mounted direct on the shaft, which controls the travel of the slide value, and therefore gives automatic expansion. The large number of these engines installed, includes four of 200-H.P. each for Messrs. Dobson, Barlow, Limited, Bolton; others for the Nuneaton electric lighting station, Lancashire mills, and for driving pumping machinery in London. The dynamo is of a patent type, having inclined magnets, the object of which is to avoid sparking at the brushes. The speed of this plant is 460 revolutions per minute.

The firm are manufacturers of multiphase machinery, and show on the stand a multiphase motor of 40 H.P. at a speed of about 750 revolutions per minute, which would work satisfactorily with a periodicity between 30 and 40; also a 3-H.P. motor of the same type. Of the continuous current motors shown, one is of the inclined type (30 B.H.P. at 675 r.p.m.). An electric winch, designed for use on board ships, is fitted with barrel brake and warp ends, also whipping drums. The whipping drums or warp ends or barrel can be used together or separately. It is fitted with a C.C. motor. This winch is shown running. On the conning tower on this stand is mounted a 24-inch projector of the type supplied for the English Admiralty, but fitted with motors as supplied to the Japanese Government and others, so that it may be controlled from a distance. This projector is to be shown in operation, the various movements being varied at will. There is also shown a 20-in. projector, such as is used for the passage of the Suez Canal, it being fitted with two diverting lenses, one of them to give a broad flat beam of equally diffused light, and the other arranged to give two separate beams, so as to leave a dark interval in the centre between them, the objective being that when two ships are approaching each other, the light does not fall directly on those in charge of the approaching vessel, and so it does not interfere with the navigation. These is also a 12-in. projector. For use in shipyards there is exhibited an electric drill with flexible shaft, which may be used for drilling holes for use with an ordinary stand, or with the special stand, or arranged on a bridge for the purpose of drilling a long series of holes. This will be shown in operation to anyone who requests.

(To be continued.)

Sittingbourne.—The D.C. has agreed to purchase the electricity works.

NEW PATENTS AND ABSTRACTS OF PUBLISHED SPECIFICATIONS.

NEW PATENTS, 1901.

Compiled expressly for this journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, Manchester, and Birmingham, to whom all inquiries should be addressed.

9,311. "Improved fuse head for electric blasting." F. Render. May 6th.

9,326. "Improvements in X ray tubes." G. H. Smith. May 6th.

9,330. "A device for quickly connecting the trolley wheel of electrically-driven tramcars or other vehicles, with the overhead wire supplying the power, and which is usable in any position of the trolley arm." E. J. Simmonds. May 6th.

9,350. "Improvements in and relating to electric furnaces for heating or re-heating objects to a predetermined degree." A. Grobet. May 6th.

9,364. "Improvements in electric arc lamps." W. C. Johnson and W. B. Esson. May 6th. (Complete.)

9,388. "Improvements in electric arc lamps." Helios-Upton Company and T. Spencer. May 6th. (Complete.)

9,405. "The training of guns by electric motors without the use of resistances." H. E. Wimperis. May 6th.

9,445. "Improvements in the rectification of high tension alternating electric currents." R. S. Wright. May 7th.

9,502. "Improvements in telephone transmitters." W. L. Wise. (C. E. Scom, United States.) May 7th. (Complete.)

9,512. "Improvements in solenoid and other electric coils." J. A. Heany. May 7th. (Complete.)

9,527. "Improvements in connection with electrical fuses." J. Y. Johnson. (The D. and W. Fuse Company, United States.) May 7th. (Complete.)

9,532. "Improvements in motor starting switches." F. J. A. Matthews. May 8th.

9,547. "Improvements in electric stop motions of drawing frames." T. Chadwick. May 8th.

9,574. "An instrument for the testing of the magnetic qualities of materials in bulk." C. V. Drysdale. May 8th.

9,586. "An invention for extending the present range of wireless telegraphy." F. Lacon and A. Foster. May 8th.

9,593. "An improved electric switch for starting motors or like purposes." Siemens Bros. & Co., Limited, and M. Hird. May 8th. (Complete.)

9,595. "Instantaneous device for securing telegraph, telephone or other wires." Q. Austen. May 8th.

9,610. "Improvements in electrical exercising machines." H. H. Lake. (A. W. Courtney, United States.) May 8th. (Complete.)

9,611. "Improvements in trolley heads for use in connection with the overhead system of electric traction." A. Metcalfe. May 8th.

9,616. "Improvements in and relating to electrical time switches." W. Rausch. May 8th. (Complete.)

9,619. "A new or improved method of conveying electric current, a new or improved apparatus in connection therewith." J. Iron. May 9th.

9,651. "An improved method for the protection of overhead systems of transmission of electric currents." C. J. R. Le Mesurier. May 9th.

9,674. "Improvements in electric arc lamps." The Jandus Arc Lamp and Electric Company, Limited, A. D. Jones, and B. M. Drake. May 9th.

9,675. "Improvements in the regulating mechanism for electric arc lamps." The Jandus Arc Lamp and Electric Company, Limited, and A. D. Jones. May 9th.

9,676. "An improved electric smelting process and apparatus to be used therein." The British Aluminium Company, Limited. (A. H. Cowles, United States.) May 9th. (Complete.)

9,692. "Improvements in underground systems for electric traction railways and the like." C. Haggenmiller. May 9th.

9,697. "Improvements in or connected with wireless and other telegraphic signalling." J. C. Bose and S. C. Bull. May 9th.

9,702. "Improvements in arc lights for photographic purposes." F. G. Notley. May 10th.

9,718. "Improvements in electrical heating apparatus." A. Eckstein and C. H. Archer. May 10th.

9,731. "Improvements in the method of lighting oil and other lamps by electricity." W. Patterson. May 10th.

9,745. "An improvement in or relating to electric current circuit breakers." E. F. Moy and P. H. Bastie. May 10th.

9,769. "Improvements in current-collectors or contact-shoes for electric railways." H. H. Lake. (McElroy Grunow Electric Railway System, United States.) May 10th. (Complete.)

9,770. "Improvements in electrical sparking devices for firing the charges in internal combustion engines, and for similar purposes." A. C. Brown. May 10th.

9,781. "An improved insulator for use with bracket suspensions of overhead trolley systems and the like." R. C. Quin and J. B. Smoth. May 11th.

9,785. "Improvements in reversing apparatus for electrical devices." R. J. Hughes and A. B. Shaw. (Date applied for under Patents, &c., Act, 1883, Sec. 103, October 13th, 1900, being date of application in United States.) May 11th.

9,801. "Improvements in electric telegraphy." S. G. Brown. May 11th.

9,812. "An improvement in controllers for electric motors for lifts and other purposes." J. Bush and M. T. Medway. May 11th.

9,829. "Improvements in automatic electric circuit breakers." The British Thomson-Houston Company, Limited, and E. B. Wedmore. May 11th.

ABSTRACTS OF PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson and Co., 322, High Holborn, W.C., and at Liverpool, Manchester and Birmingham, price, post free, 9d. (in stamps).

1899.

14,010. "Improvements in means for use in the production of radiation and light by electricity." J. Swinburne. Dated July 6th, 1899. Lamps for producing radiation and light, such as those described in Specifications No. 21,218, A.D. 1896, and No. 14,059, A.D. 1898, in which electric discharges in exhausted vessels are directed against solid bodies, and which have extensions containing material through which sparks may be passed to reduce the vacua, are now provided with choking coils or like means of producing counter electromotive forces in the auxiliary sparking circuits, in place of the resistances and condensers described in the specifications referred to. 1 claim.

14,908. "Improved method of and apparatus for indicating potential in systems of electrical distribution." R. D. Mershon. Dated July 19th, 1899. (Date under International Convention, February 1st, 1899.) Current meters.—The pressure between any points of two conductors, supplying a terminating current to a single or a distributed load, is indicated at any other point on the circuit by a voltmeter included in a small local transformer circuit, in which inductances, capacities and resistances are arranged to modify the pressure derived from the near portions of the main conductors as it is modified at the distant points by line resistance and inductance, and especially by line capacity and leakage. In one arrangement, current is supplied from an alternator through mains, to a single load, the main having non-inductive and inductive resistances, inserted in it. A volt-meter is connected through the secondary of the pressure transformer to the ends of the series of resistances and thus indicates the pressure at the alternator, less the fall due to passage of the main current through these resistances. The middle of the series of resistances is connected to the opposite conductor of the voltmeter circuit by a shunted condenser, corresponding to the capacity and leakage between the mains. To compensate in the voltmeter circuit for idle current flowing through the resistances, the ends of this series may be connected through a shunted condenser to the secondary of a small pressure transformer connected reversely; the shunted condenser represents the line capacity and leakage for this balancing transformer. In modifications, the circuit may be connected directly to the terminals of the voltmeter, instead of to the ends of the series of resistances. The single-shunted condenser may be replaced by several connected between the resistances and the opposite voltmeter conductor, to better represent distributed capacity and leakage. If the load is distributed on the mains it is represented, similarly to the line leakage, by non-inductive or inductive resistances, the voltmeter being connected between points on the voltmeter circuit corresponding to those in the main circuit between which the pressure is desired to be known. Instead of placing the resistances in the main circuit, the secondary of a main current transformer may be connected to the voltmeter terminals, the voltmeter circuit being thus entirely disconnected metallically from the main circuit. The resistances may be combined. The circuit may be replaced by an inductance, when the line leakage is negligible, and the frequency constant. The transformers may have a common primary winding. 3 claims.

14,909. "Improvements in dynamo-electric machines." B. G. Lamme. Dated July 19th, 1899. (Date under International Convention, April 14th, 1899.) Armatures, field magnets, ventilating, distortion of field, preventing.—The armature core is built up of toothed laminæ, which are separated into groups by spacing-plates provided by lateral ribs, so as to form ventilating channels. The field-magnet core is constructed of overlapping segmental laminæ, which are likewise divided into groups by ribbed spacing-plates forming ventilating channels, preferably in the same planes as those of the armature. It is secured by dovetail joints to a tubular spider. As the field magnet is rotated, it acts as a blower, forcing air through the openings in the spider and the channels in the field magnet and armature. The field coils are retained in position by means of wedges engaging with grooves in the sides of the poles, or with rods laid in the said grooves. Two such wedges are inserted from opposite sides, and are clamped together in the middle. The wedges are provided with ventilating openings, and with lateral flanges projecting over the adjacent pole-tips; they are preferably constructed of well-conducting metal, such as copper or brass, forming closed circuits for the purpose of destroying the distorting effect due to armature reaction. A number of conduction bolts may be passed through the pole-pieces near their ends, so as to clamp the laminæ together, and form additional closed conducting circuits. 3 claims.

14,998 "Improvements in fuse blocks for electric circuits." H. P. Davis. Dated July 20th, 1899. (Date under International Convention, March 23rd, 1899.) The fuse wire is contained in a channel in the removable part of the fuse-box, and is secured to terminals adapted to engage with contacts on the fixed part. The part is formed with a projection adapted to pass through an orifice in the fixed part, and is locked in position by a clamping-nut. This nut may be arranged with a bayonet-joint connection, as well as with a screw. The joint of the parts may be made water-tight by means of a rubber screw. A passage 8 may be provided for the escape of gases and for extinguishing the arc. 2 claims.

15,002. "Improvements in electric arc lamps." J. B. Barton and Messrs. The Jandus Arc Lamp and Electric Company, Limited. Dated July 20th, 1899. Relates to arc lamps. The upper carbon is carried in a central tube by four clutch-rings supported in inclined radial slots in an annular block fixed on the tube and loaded with lead. A ring passed through the clutch-rings prevents these from dropping out. The tube is hung from the smaller half of a rotating piece, the larger half of which supports a core in a series solenoid, the clutch-tube thus having only half the extent of motion of the core. The core fits the solenoid bobbin, the lower end of which is nearly closed by a lift valve, to check downward movement of the core. At its upper end the core carries a thin iron disc which is stated to considerably damp its movements magnetically. A series resistance is carried on insulators. 2 claims.

15,017. "Improvements in electric accumulators or secondary batteries." H. Weymersch. Dated July 21st, 1899. Relates to plates which are made in the manner described in Specification No. 129, A.D. 1881, and consists in mixing pyridine or any of the salts belonging to the same group with the acidulated water which is used for mixing the oxides into a paste preparatory to placing them on the grids or frame. The plates, when dry, are dipped alternately in acidulated water and in a solution of pyridine, acidulated water and alcohol. 1 claim.

15,018. "Improvements in and relating to telephone switches and switchboards." G. Gilmore. Dated July 21st, 1899. Exchange operator's switches for connecting the apparatus to any one of a number of plug circuits. The plug circuits are arranged with jack springs of various types either in the arc of a circle or in a straight line. The corresponding connections for the operator's apparatus are assembled to form a rotating jointed lever, a separate plug, a rigid lever, when the jack springs are set horizontally, or a sliding connection. 6 claims.

15,066. "Improvements in systems of electrical distribution." B. G. Lamme. Dated July 21st, 1899. (Date under International Convention, January 30th, 1899.) In transformer distribution, in order to vary the electromotive force, a third coil, the effective length of which is variable, is arranged on the transformer, and the variable electromotive force is impressed on the circuit through a second transformer. In one arrangement the effective length of the additional coil is varied by means of a switch and the electromotive force is impressed on the circuit through the transformer coils. 3 claims.

15,128. "Improvements in plug contacts or contact plugs for electric circuits." O. D. Lucas. Dated July 22nd, 1899. A connector suitable for use in lighting theatre stages, comprises a box adapted to be let into the floor and a plug fitting in the box, into which are fitted the contacts. the leading-in wires being connected to terminals. The plug is hollow, and is fitted with a hook adapted to take in a recess and carries contacts. The leading-out wires are connected to these contacts, and pass out through an extension or handle which rests in an opening in the box. The lid is hinged, and is large enough to cover the handle when the plug is inserted. 3 claims.

15,135. "Improvements in electrical clock arrangements and apparatus." F. T. Hollins and F. W. Leake. Dated July 22nd, 1899. Relates to electric clocks. In secondary clocks the driving armature lever is connected to a dash-pot, which retards its return after attraction. In connection with the master clock an armature similarly controlled by a dash-pot, and having a branch normally vibrates against the end of a bent switching arm, but, if the periodic current is delayed in occurrence or fails, the armature sinks clear of the switching arm, which accordingly swings over to the terminal and so brings a reserve master clock into circuit. A similar arrangement utilises the reserve clock if the periodic current passes for too great a length of time. 5 claims.

15,139. "Improvement in automatic electric circuit breakers." G. Wright and C. Aalborg. Dated July 22nd, 1899. (Date under International Convention, March 23rd, 1899.) A magnetic circuit breaker is fitted with a toggle joint between the handle and switching device with an auxiliary shunt contact to the main contact and with a rubbing carbon contact for the final rupture. The main contact is fixed to an arm or frame pivoted to brackets. It carries an additional metal contact always in contact with the terminal on which the releasing magnet is fitted. The sparking contact is carried on an arm pivotted to the frame and connected to a handle by a spring. It is arranged to first slide and then tilt. The handle is pivoted to the brackets, and is connected to the arms by a toggle-lever. The armature of the magnet is carried by a frame carrying an adjustable weight. The arm is locked in the on position by a pivoted catch engaging with a projection on the toggle-lever. It is controlled by projections on the frame. 2 claims.

15,166. "An improved form of electrically-actuated railway signal." W. E. Langdon. Dated July 24th, 1899. Semaphore, &c., signals; lamp signals; signalling, &c., between trains; indicators and repeaters, signal. The specification refers to a figure which is too complicated for purposes of abridgments. 3 claims.

15,178. "Improvements in the brushes of dynamos." F. J. Chaplin. Dated July 24th, 1899. Brushes for dynamos are made from strips of spirally-woven copper wire mesh. These strips are cut up into the required lengths, then compressed to the desired thickness, and afterwards trimmed or bevelled at the end. The strips may comprise first a layer of compound coils, then a layer of single coils intertwined with the compound coils, and, finally, another layer of compound coils intertwined with the single coils; or layers of single coils or compound coils only may be used. In some cases layers of cross spirally-woven mesh are employed to give greater stiffness. 4 claims.

15,207. "Improvements in the production of battery plates or other articles by electrolytic or chemical deposition of spongy metal." P. Neumann. Dated July 24th, 1899. Relates to the deposition of metals from their solutions either chemically or electrolytically, and has for its object the deposition of such metal in hard firm layers, the upper or outermost layers being deposited, if desired, in a soft or spongy condition. The invention is particularly applicable to the production of plates of secondary batteries, but is equally applicable to the plating of articles with a coating of metal of varying density. In the case of the employment of chemical means as in the precipitation of lead from lead acetate by the addition of zinc, the solution is placed in a cylindrical vessel, which is rapidly rotated, the articles to be coated being attached to the walls of the vessel. In the case of the employment of electrolytical means, the articles are suspended in contact with a cylinder, which forms the cathode and contains the electrolyte. The anode consists of a ring or disc immersed in the electrolyte and reaching almost to the walls of the cylinder. The cylinder is mounted on a spindle so that it can be rotated, and by varying the rapidity of the rotation, the density of the deposit is also varied. This electrolytic method is especially applicable to the production of accumulator plates. 2 claims.

15,210. "Improvements in electric arc lamps." F. G. Chagneaud. Dated July 24th, 1899. This specification cannot be described without reference to a design. 7 claims.

15,138. "Improvements in electric generators and motors." B. G. Lamme and J. P. Mallett. Dated July 22nd, 1899. (Date under International Convention, February 6th, 1899.) Relates to windings for the armatures of polyphase generators or the primary members of induction motors. The bars constituting the winding are made of such dimensions, and are joined together at their ends in such a manner that all the connectors are of the same shape and length. A development of a 3-phase 4-pole winding comprising 72 bars is shown, there being four bars of each phase per pole. One of the middle bars *d e* of each group of four projects equally beyond the two ends of the core, the symmetrically projecting bars being alternately long and short. The bars *f g* on either side are of intermediate length, and project evenly with the short bars at one end and with the long bars at the other end. One end of each of the bars *d* is joined by a connector *h* to the nearest bar *g* of the same phase on one side, and the opposite end is joined by a connector *i* to the nearest bar *f* of the same phase on the other side. The bars *e* are similarly connected to the bars *f* and *g*. In the case of a 3-phase 4-pole winding comprising 60 bars, the middle bar of each group projects symmetrically, the several middle bars being alternately long and short, while the bars on either side of them are of intermediate lengths. 4 claims.

15,268. "Improvements in electric lamps. The British Thomson-Houston Company, Limited. (E. W. Rice, jun.) Dated July 25th, 1899. Incandescent arc lamps; supporting lamps.—A body, A, which becomes conductive only at a high temperature is mounted between insulated supports, F, E, connected in series with an upper solenoid, O, an electro-magnet, E^1, and terminal plates, N^2, P. The body, A, is enclosed by two conductors, B, C. The lower conductor, C, is connected with the support, F. The upper conductor, B, is carried by the tubular core of the two solenoids, O, S, the upper part of the core sliding in an insulated tube, V, which serves as a dash pot. The core carries springs to make contact with the tube which is connected through the lower solenoid, S, two contacts, and a spring-held armature, E^2, with the terminal plate, P. The body, A, and coils, O, E^1, are thus connected in parallel with the conductors, C, B, and coil, S. When current is supplied the solenoid, S, raises the core and conductor, B, forming an arc which heats the body, A; when this becomes incandescent and conductive the electro-magnet, E^1, attracts the armature, E^2, opening the circuit of the conductors, B, C, while the upper solenoid, O, continues to hold up the core and conductor, B, to allow passage of light from the body, A. The solenoids are enclosed in a casing, E^3, against which a globe is held by a nut, I. The top of the lamp screws into a support, H, which carries contacts to connect the plates, N^1, P, of the lamp with terminal screws, I^1, I. 41 claims.

15,309. "Improvements in insulating electrical conductors." W. W. Colley. Dated July 25th, 1899. Paper or other fibrous material is impregnated with a mixture of one or more of the following materials:—Turpentine, creosote, or naphthalene or resin with glycerine. The turpentine may be treated with sulphuric acid, and the creosote or naphthalene with caustic soda. 7 claims.

15,369. "Improved arc lamp having two arcs in series." W. Mathieson. Dated July 26th, 1899. Arc lamps.—An arc lamp is provided with three or four carbons placed in a line; the end carbons are connected in circuit, so that two arcs in series are formed between them and the middle carbon or carbons. The end carbons may be movable by two separate clutch mechanisms, one provided with a series coil, and the other with a shunt coil or differentially-acting coils. The lamp illustrated has an arc enclosing cylinder, in which the middle carbon is supported by thin plates depending from the cover. The end carbons pass through gas checks into the cylinder. With open continuous-current arcs, two middle carbons of different thicknesses are carried by a support on the side rods of the lamp. Two globes may be used, either separate, or in contact at the middle. In a modified arrangement of lamp, the middle carbon and the globe are connected by a chain passed over a roller to the upper carbon, and the lower carbon moves twice the distance passed over by the others, or the globe may move with the lower carbon. 3 claims.

15,370. "Improved secondary and storage battery." T. de Michalowsky. Dated July 20th, 1899. Relates to batteries in which zinc replaces the spongy lead plate, and consists in substituting nickel covered with nickel oxide ($Ni_2 O_3$) for the lead-peroxide plate. The oxide is preferably formed at a temperature above 300° C., by heating the nickel in ammonium nitrate, but other substances may be employed to effect the oxidation, such as pure oxygen, compressed air, and chlorates. 1 claim.

15,418. "Improvements in insulated electrical conductors for cables." H. Edmunds. Dated July 27th, 1899. Conductors are coated with spirals of paper, and are finally saturated with a mixture of sealing and waterproofing compositions. Coverings or braided jute, &c., or final armourings may also be employed. The paper strips employed are saturated with (1) a sealing or waterproofing composition, consisting of a mixture of resinous matter, such as colophony, and oxidised oil such as blown vegetable or fish oil; and (2) an oily matter, such as a heavy mineral oil, with or without mineral wax. The spirals are arranged alternating, the outer layer being of the sealing, &c., paper. 1 claim.

15,426. "An improved electric battery and process for constructing electrodes for the same." A. Trobelhorn. Dated July 27th 1899. The plates or electrodes are provided on each side with grooves on the shape of conical helices to hold the positive and negative active material respectively. The edges of the grooves are bent over to hold the active material in place. Radial ribs are formed on the under side of the electrodes, and shoulders project from the sides of the upper grooves into the active material, but the latter may be replaced by metal pieces which are formed separately and embedded in the active material. Radial channels along the under side of the plates allow of the escape of gas and glass balls serve to separate adjacent electrodes from each other. Cannot be abridged without reference to a figure. 12 claims.

15,440. "Improvements in electric incandescent lamps." M. von Rockling-hausen, A. Vogt and Nernst Electric Light, Limited. Dated July 27th, 1899. Incandescent lamps. An incandescence body requiring preliminary heating to render it conductive is heated by a platinum wire, coiled without strain on a thin rod, plate, or flat tube or porcelain. Such a rod may form an open helix surrounding a vertical incandescence body, or a zig-zag, hung at its ends from conducting wire loops in line with a horizontal incandescence body, in order that it may remain under this if the lamp is inclined. A flat tube or plate may be hung similarly, in a vertical plane, to obstruct the light as little as possible. The wire is coiled more closely near the ends of the support to produce uniform heating. A controlling resistance used in series with the incandescence body consists of a plate wound similarly with wire, which becomes highly heated, so that its resistance increases rapidly as the current increases. 5 claims.

15,486. "An improved method of, and apparatus for, stamping electrode plates." C. Tufenthal, jun., K. Meyer and F. Neblung. Dated July 28th, 1899. The plates or electrodes are indented on each side, the indentations on each side of the plate being in line with each other. The indentations do not extend through the plate, so that a central web is left. The plate is mounted in a frame, which is secured between two perforated plates, which are mounted on guide pins, and the upper plate rests on springs of regulated strength. The indentations are made by cylindrical punches, the latter of which are fixed in a bedplate, while the former are fixed in a press head. 2 claims.

15,525. "Improvements in electric switches." R. W. K. Hofstede-Cruil. Dated July 28th, 1899. Cannot be described without reference to a figure. 2 claims.

15 551. "Improved means for supporting electric incandescent lamps." C. Davidson. Dated July 29th, 1899. Supporting lamps.—An incandescent lamp is hung by an india-rubber cord from a ring which slides on a wire stretched horizontally between two supports on a ceiling, so that the lamp can be moved to any part of the wire, or drawn down. The lamp is connected to separate insulated conductors, which are coiled and attached to an insulator on the india-rubber cord. From this the conductors extend oppositely to two spring drums, rotatable in casings, fixed near the ends of the wire, electric connection being made by springs bearing on their axles. Or the conductors may be passed round pulleys attached to the ceiling and to weights, their ends being secured in ceiling roses. The springs or weights hold up the conductors in any position of the lamps. The provisional specification states that the ring may be dispensed with, the lamp being supported by the conductors only, which will permit it to be drawn down. 3 claims.

15,581. "A combined switch and ceiling rose or other like fitting for electric lighting purposes." S. Jevons and W. H. Lloyd. Dated July 29th, 1899. A ceiling rose or the like fitting is provided with a switch, so that by pulling the flexible wire or by operating a plunger, the lamp is switched on or off. The base is formed with two projecting pieces forming guides for a sliding block which is normally held up by a spring. The block is fitted with metal contact pieces, and to it are secured the conductors. The moving contacts of the switch are fitted on the squared parts of the spindle of a drum which passes through a slot in the sliding block. The spindle is fitted in supports carrying cams. Plates sliding on the spindle carry rollers, and are pressed against the cams by springs. The drum has ratchet teeth, and is turned by a pawl fixed to the sliding block when this block is pulled down. One quarter turn of the drum moves the contacts on, and the next turn moves them off, the cams giving a quick movement. 2 claims.

15,599. "Improvements in or relating to electric switches and like apparatus for making and breaking electric circuits." G. W. Partridge and G. K. B. Elphinstone. Dated July 29th, 1899. For extinguishing the arc formed on breaking the circuits, the contacts are fitted in chambers in which a vacuum is produced at the moment of breaking contact, and air is then suddenly admitted. The fixed contacts are fitted in chambers and the movable contacts are carried by rods on which are fitted pistons arranged to produce a partial vacuum on being withdrawn, but which are returned easily. Suitable valves may be fitted controlling the admission of air. The cross-bar is arranged to slide on a tube (*a*) around which is a coiled spring for giving a quick break. This bar is connected to an L-shaped bar sliding in a slot in the tube (*a*) and fixed to the tube (*b*). The tube (*b*) is locked with the switch "on" by a catch engaging in a slot. It is released by pressing a part of the handle, which through the rod and pawl force back the catch. There is a guide-rod to prevent rotation. 4 claims.

15,614. "Improvements in coin-controlled telephone registers." T. J. Hock, Jun., and E. Hoppersberger. Dated July 31st, 1899. Telephone systems.—Mechanism for registering the number of telephonic calls, &c., made after the insertion of a coin into a shute, the coin acting on a trip detent to allow the hand lever to be moved, or moving by its insertion a pivoted thrust block and link operating the rotating arm. The hand lever moving through a slot in the casing, has that slot covered by a strip, the front end of which closes the electric contacts at the end of its travel. The hand lever is provided with a pawl for engaging with the rack to prevent backward motion before the pawl is freed at the end of the travel. A locking spring and releasing rod are carried by the hand lever for controlling the pawl. The hand lever also carries a detent for engaging with one or more projections on the dial rings. The pawl can only engage with the inner ring except when that ring is in position to allow the tens ring to be moved, and similarly with the outer rings. Detent springs engage in notches in the rings. 3 claims.

15,807. "Improvements relating to the terminals of electric batteries and the like." A. C. Wright. Dated August 2nd, 1899. Relates to the terminals of electric batteries and the like, and consists in making them with a flattened end, and with a circular or other flange or head at its outer extremity. To improve the grip or hold, snugs or projections are formed on the flattened part, and a hole may be pierced in this part for the same purpose. 2 claims.

15,816. "Improvements in electro-magnetic rail brakes." A. Wilde. Dated August 2nd, 1899. Brakes, electro-magnet. A diagrammatic longitudinal elevation is shown of a car frame fitted with main and auxiliary multipolar electro-magnetic rail brakes. The outer pole shoes are suspended by links from the guided sliding bolts, which are supported by weighted rock levers arranged between stops. These levers are in the case of the main brakes fitted longitudinally and have a sliding connection, but for the auxiliary brakes are arranged transversely and pivoted to lugs formed on the bars which connect the sliding bolts. 2 claims.

15,911. "Improvements in or relating to electro-magnetic apparatus." W. F. Jones. Dated August 3rd, 1899. The electro-magnets of magnetic clutches, brakes, and other devices have the armatures made of one kind of iron or steel, and the magnets of another kind. 2 claims.

16,055. "Improvements in electric switches." W. F. Jones. Dated August 5th, 1899. Relates to means for operating a switch, so that the speed at which the circuit is made is independent of the speed at which the handle is moved. The movement of the handle winds up a weight or spring, which serves to subsequently operate the switch contacts. The handle is keyed on a spindle on which is also fixed a disc. Loose on the spindle is a pulley on which the chain supporting the weight may be wound. On the disc is a stop adapted to engage with a spring bolt carried on the pulley. On turning the handle, the pulley is turned until the movable stop strikes the top, when the stop passes the bolt allowing the pulley to turn back under the pull of the weight. The pulley then operates the switch proper through any suitable clutch or mechanism. Instead of the bolt a spring-controlled pivoted lever may be employed. An arrangement is shown for operating the pulley in either direction, or for a reversing switch. 5 claims.